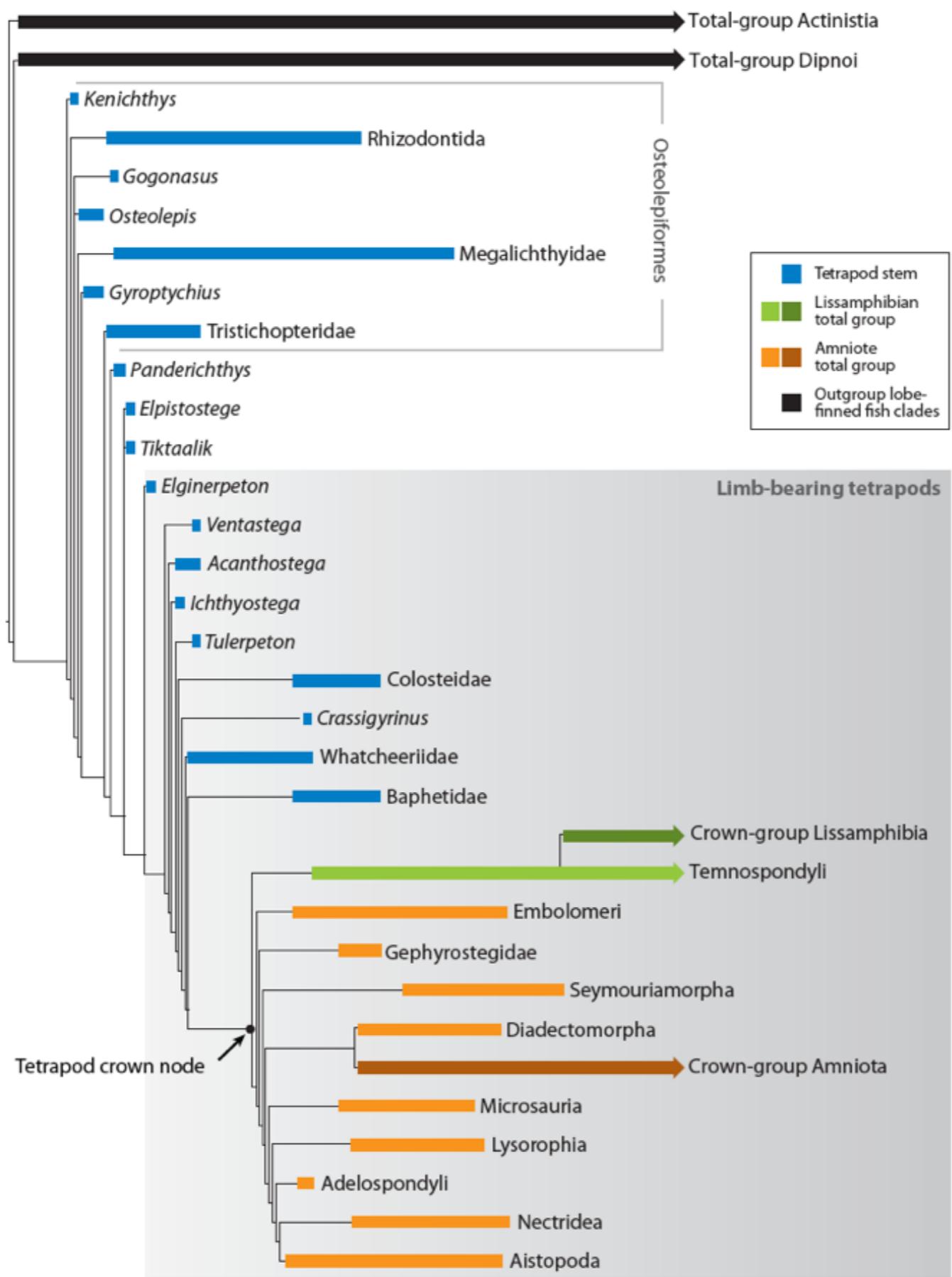
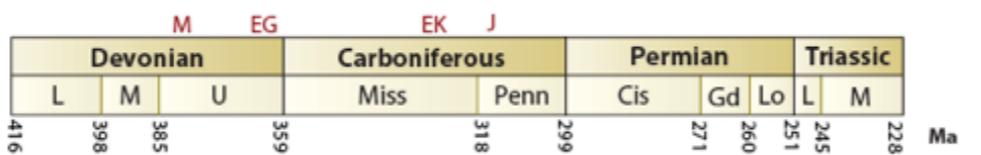
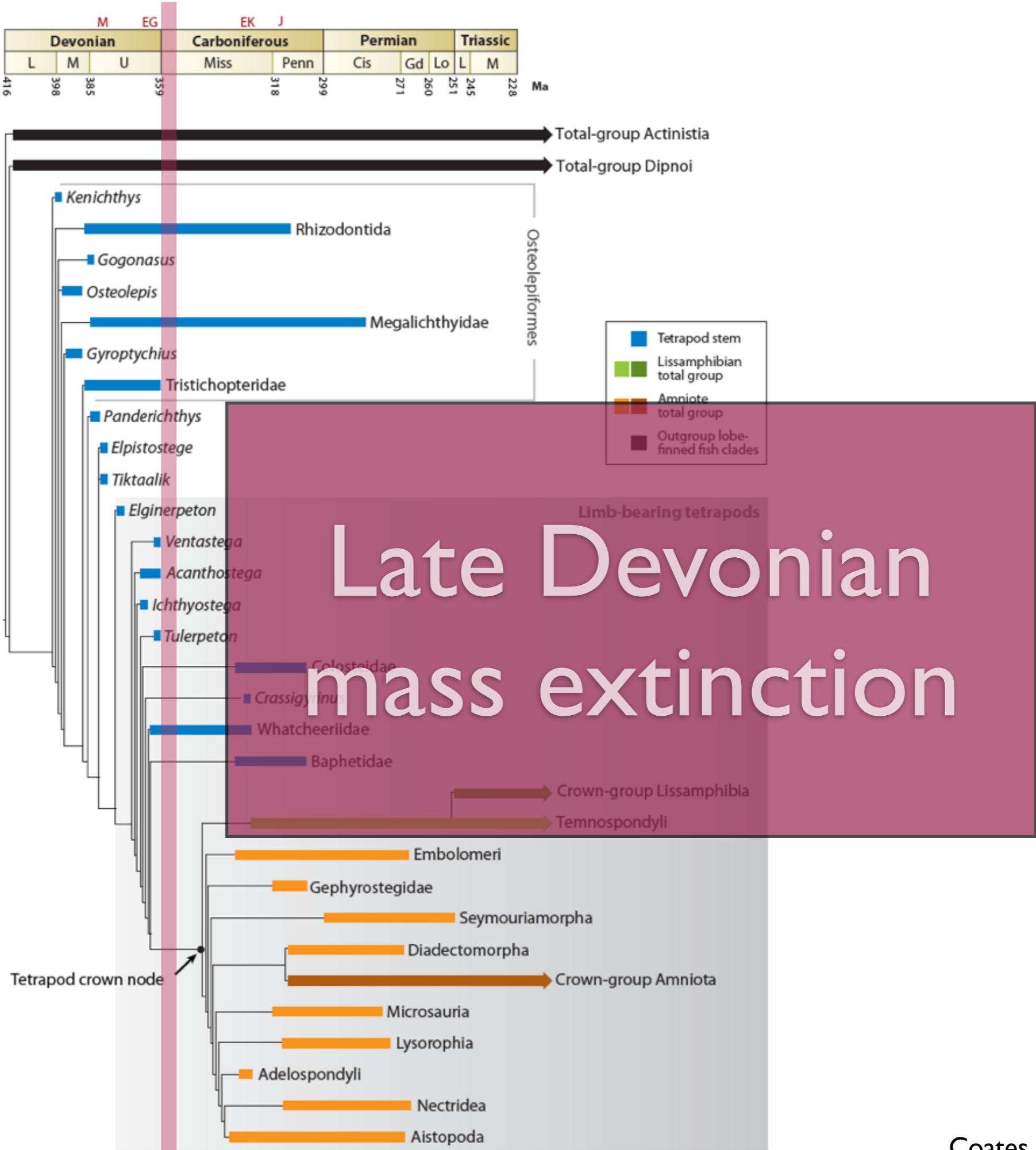


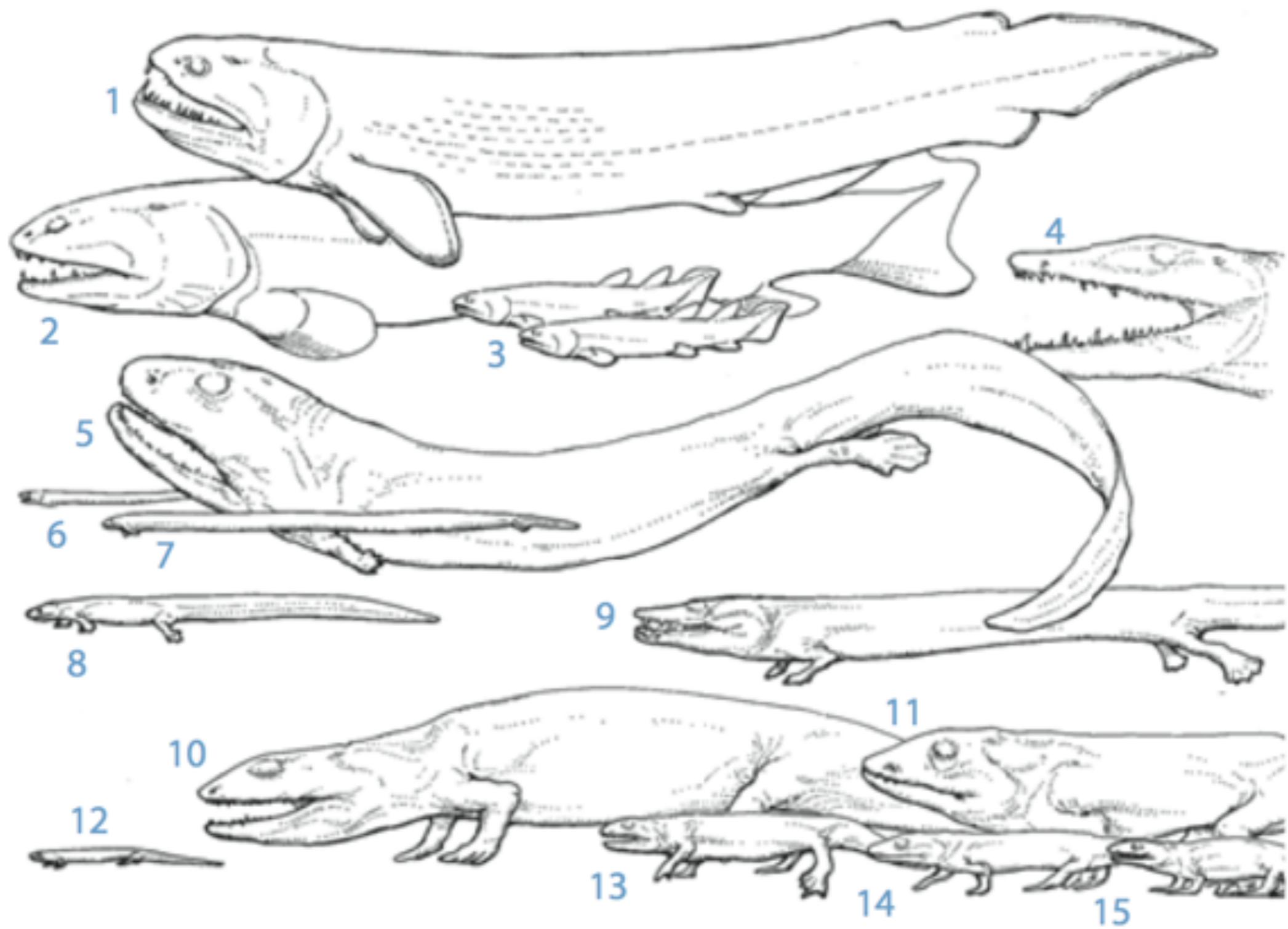
Origins of reptiles and amphibians

Herpetology
29 August 2016





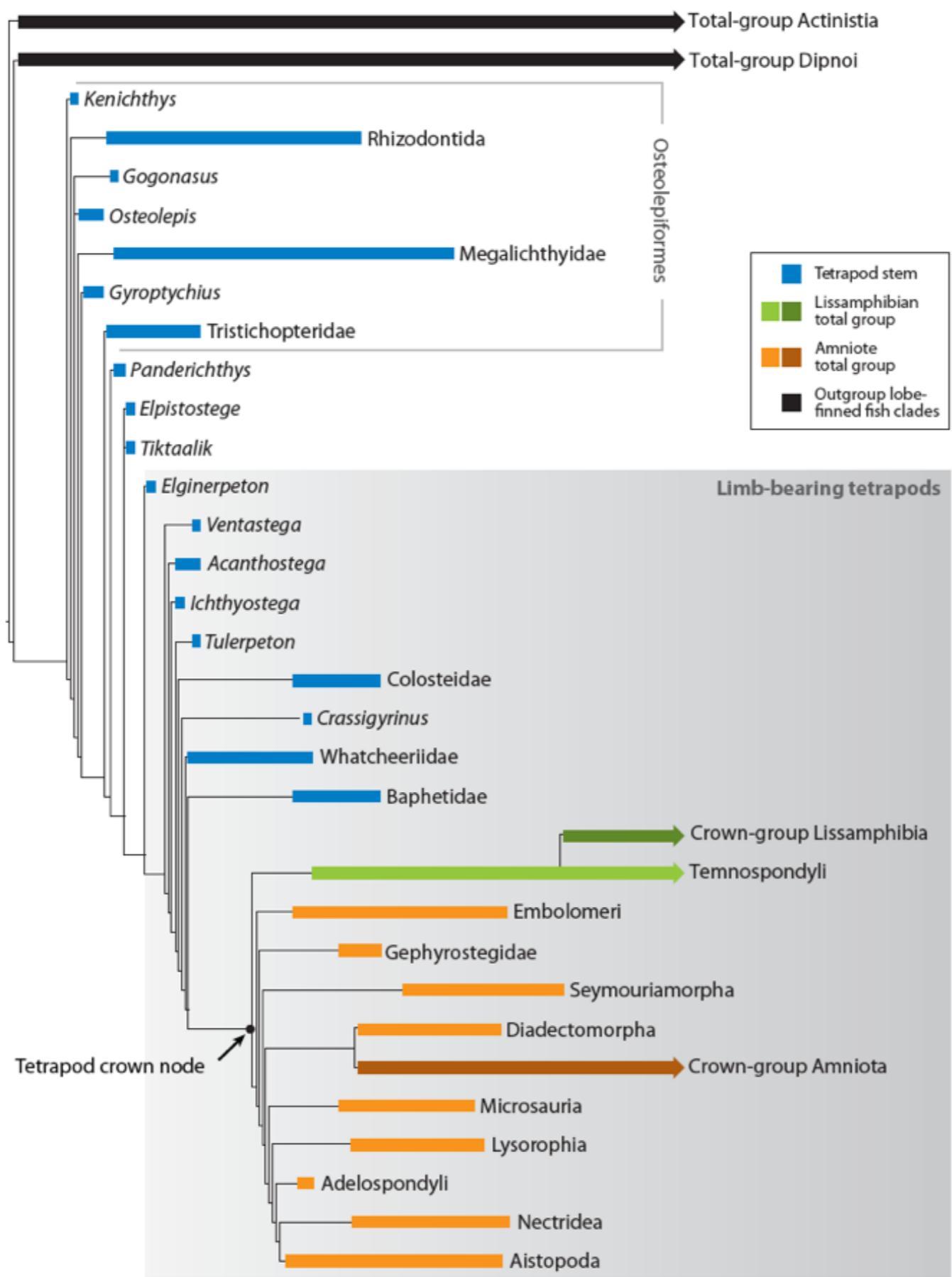
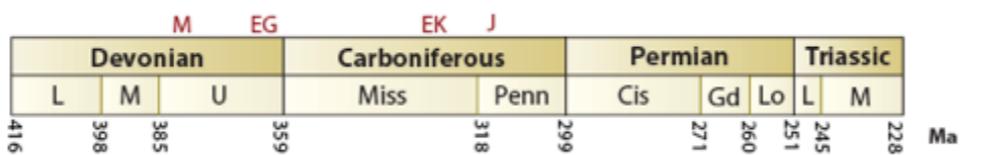
Carboniferous tetrapods

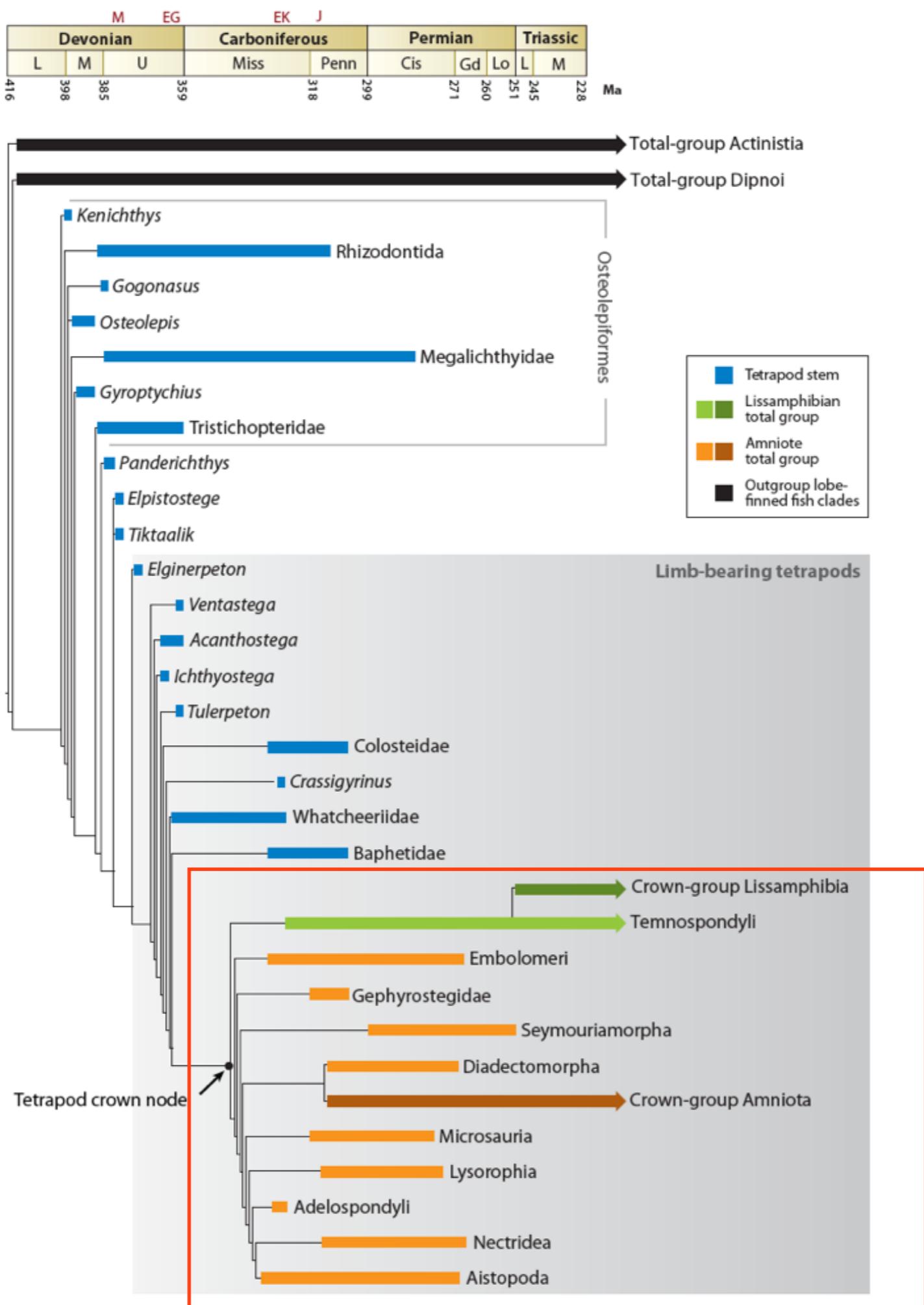


1 m



***Crassigyrinus* will haunt your nightmares**





Crown-group tetrapods illustrate the rapid divergence
of today's major tetrapod groups:

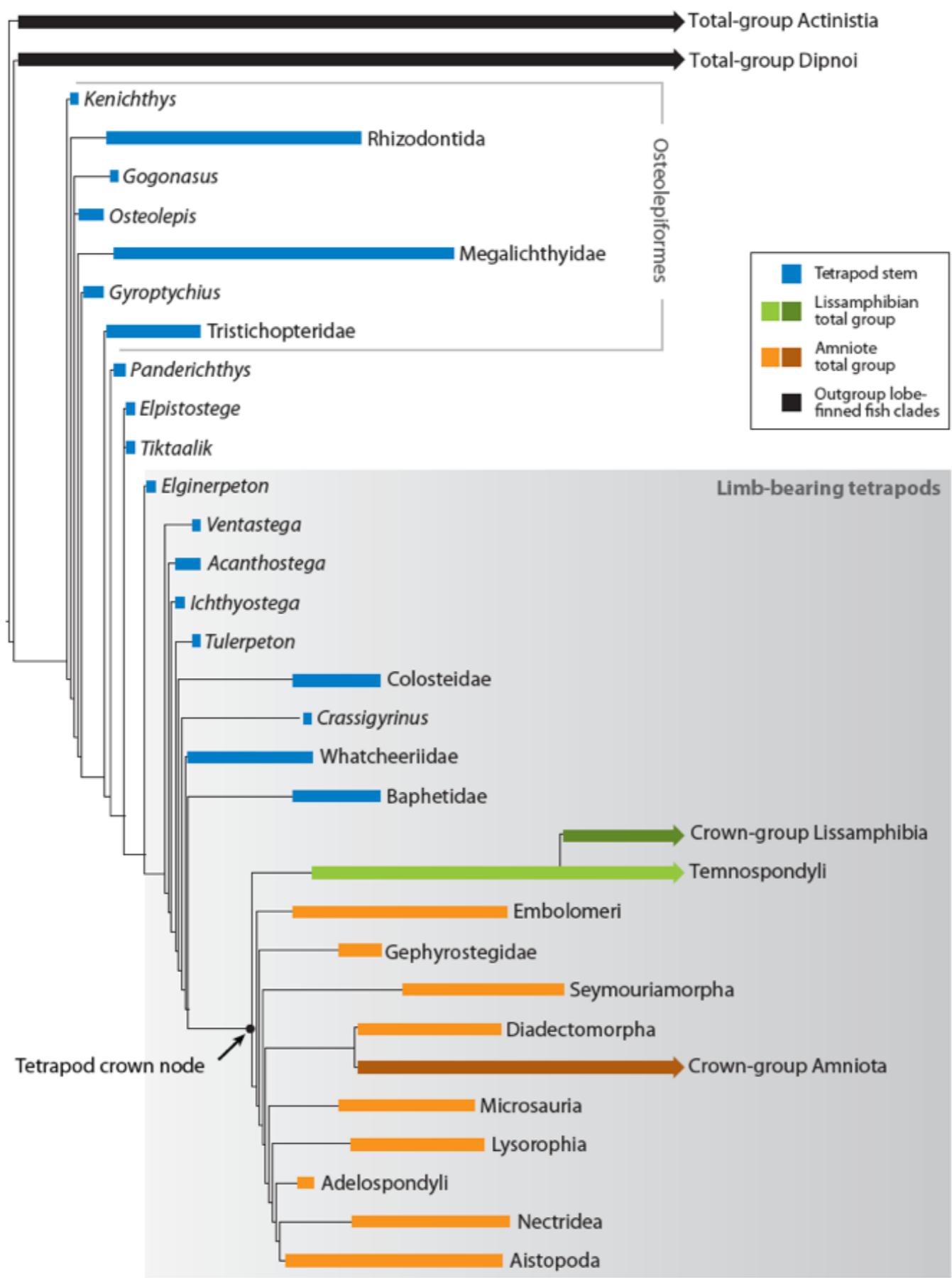
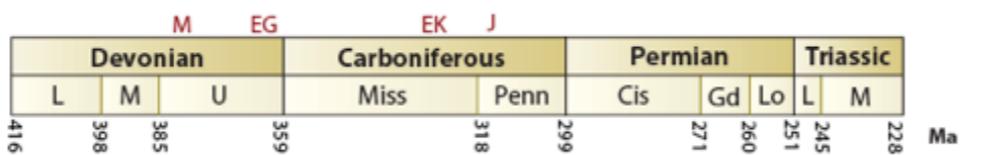
Crown-group tetrapods illustrate the rapid divergence
of today's major tetrapod groups:

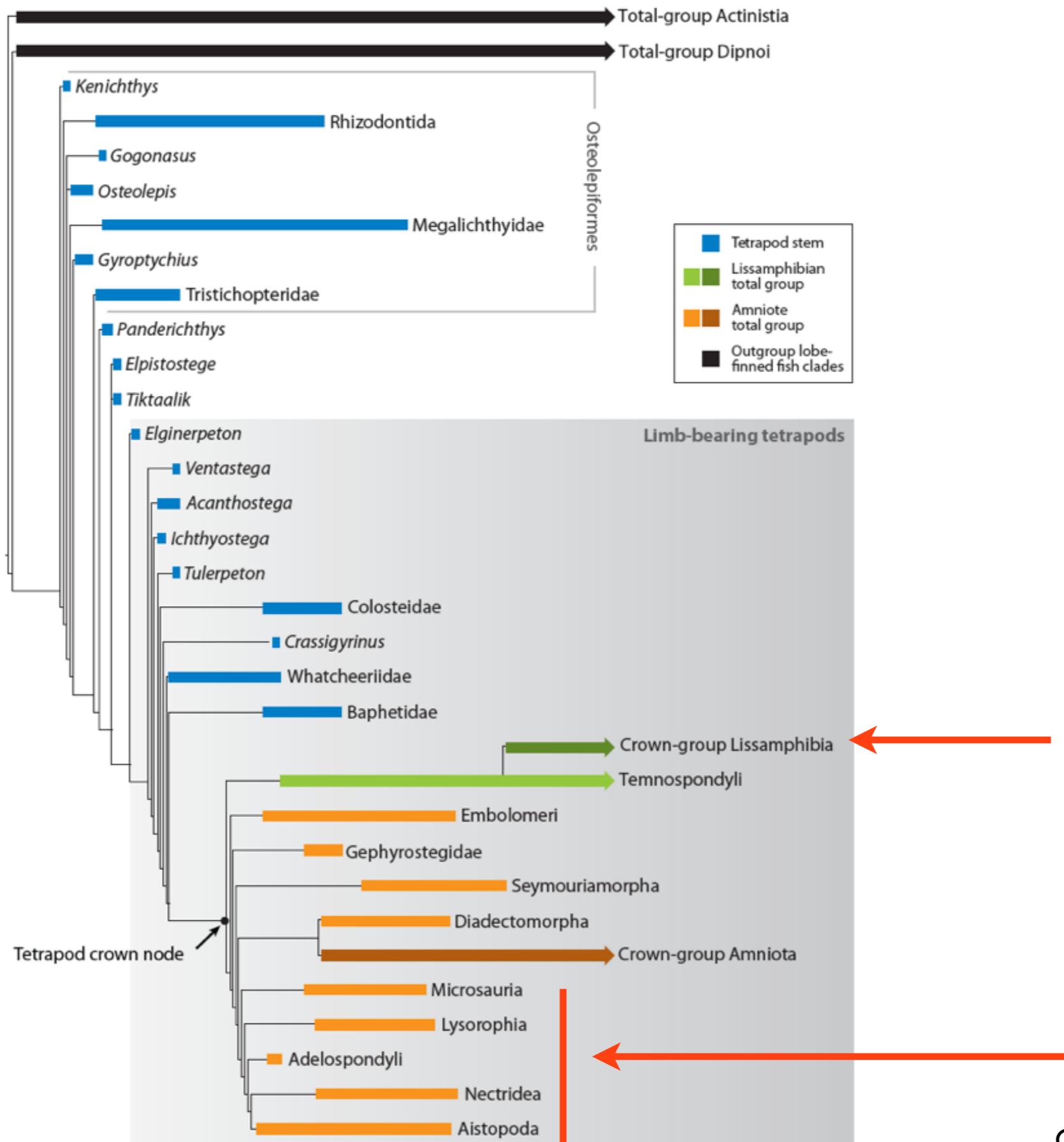
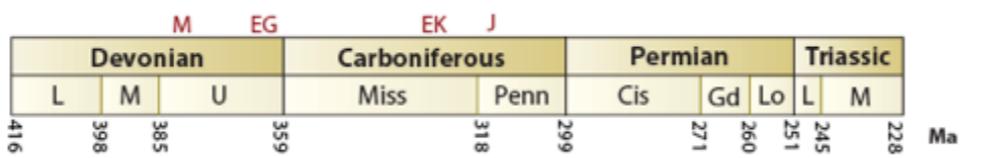
amphibians, reptiles (including birds), and mammals

Crown-group tetrapods illustrate the rapid divergence
of today's major tetrapod groups:

amphibians, reptiles (including birds), and mammals

but there is also a diversity of tetrapod clades from the
Carboniferous that left no modern descendants





Origin of Lissamphibia

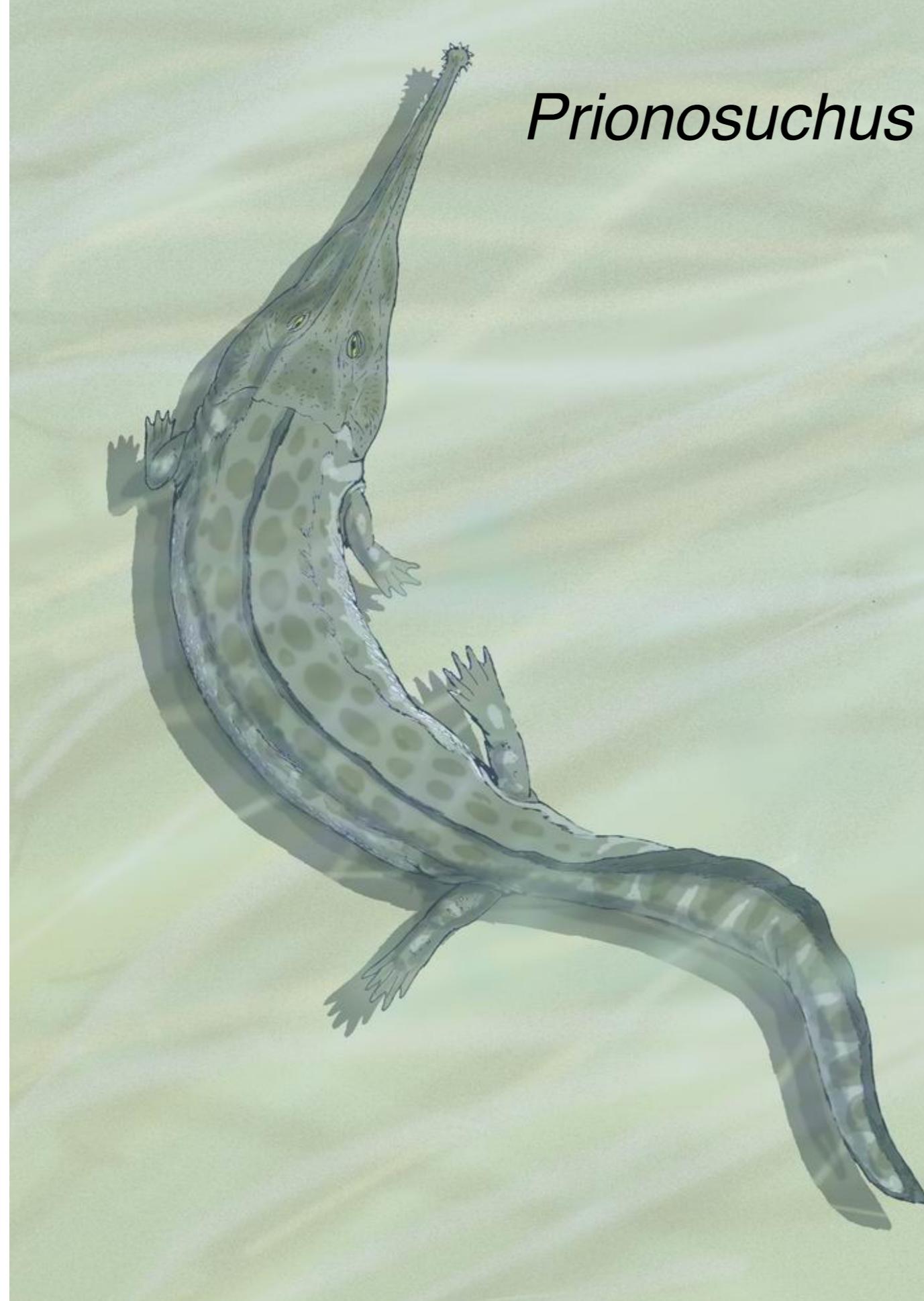
- Their extinct relatives are extremely contentious
- Probably came from one of two groups: Temnospondyls or Lepospondyls
- This is a major unsolved problem in herpetology

Temnospondyls



wikipedia

Capetus

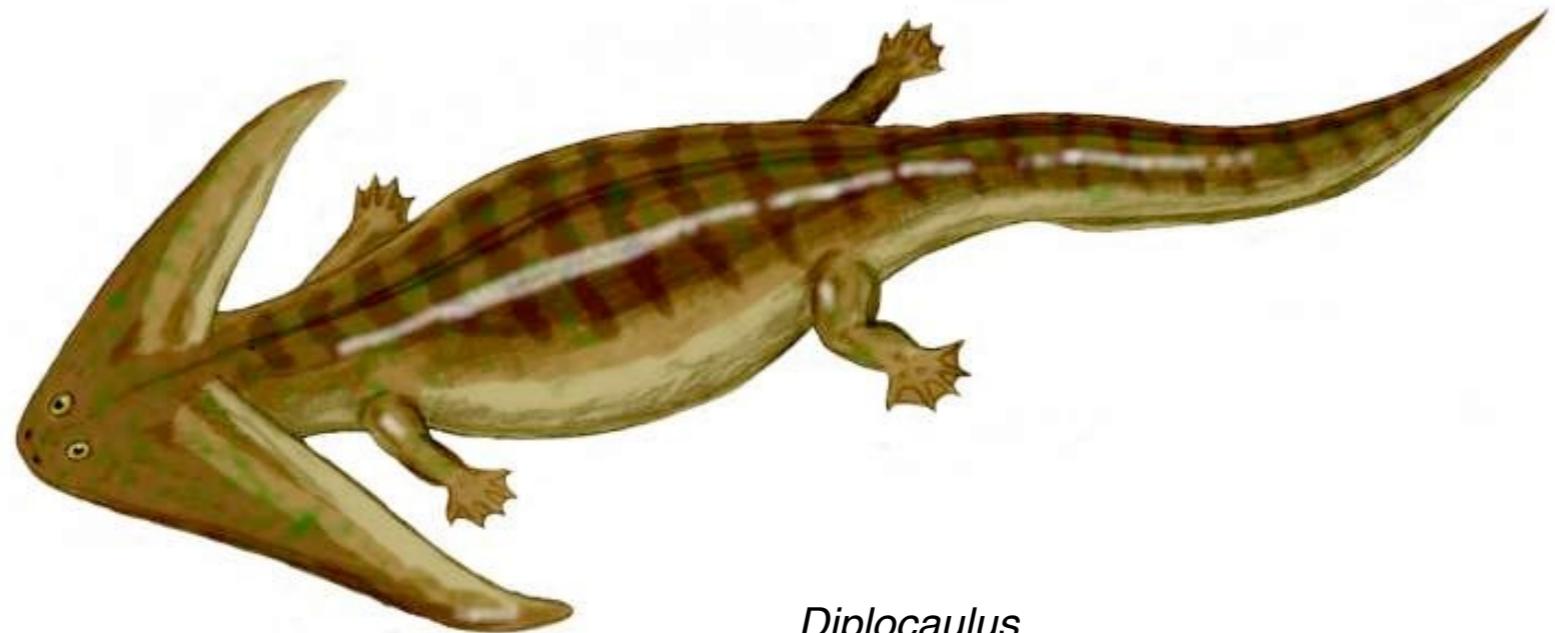


Prionosuchus

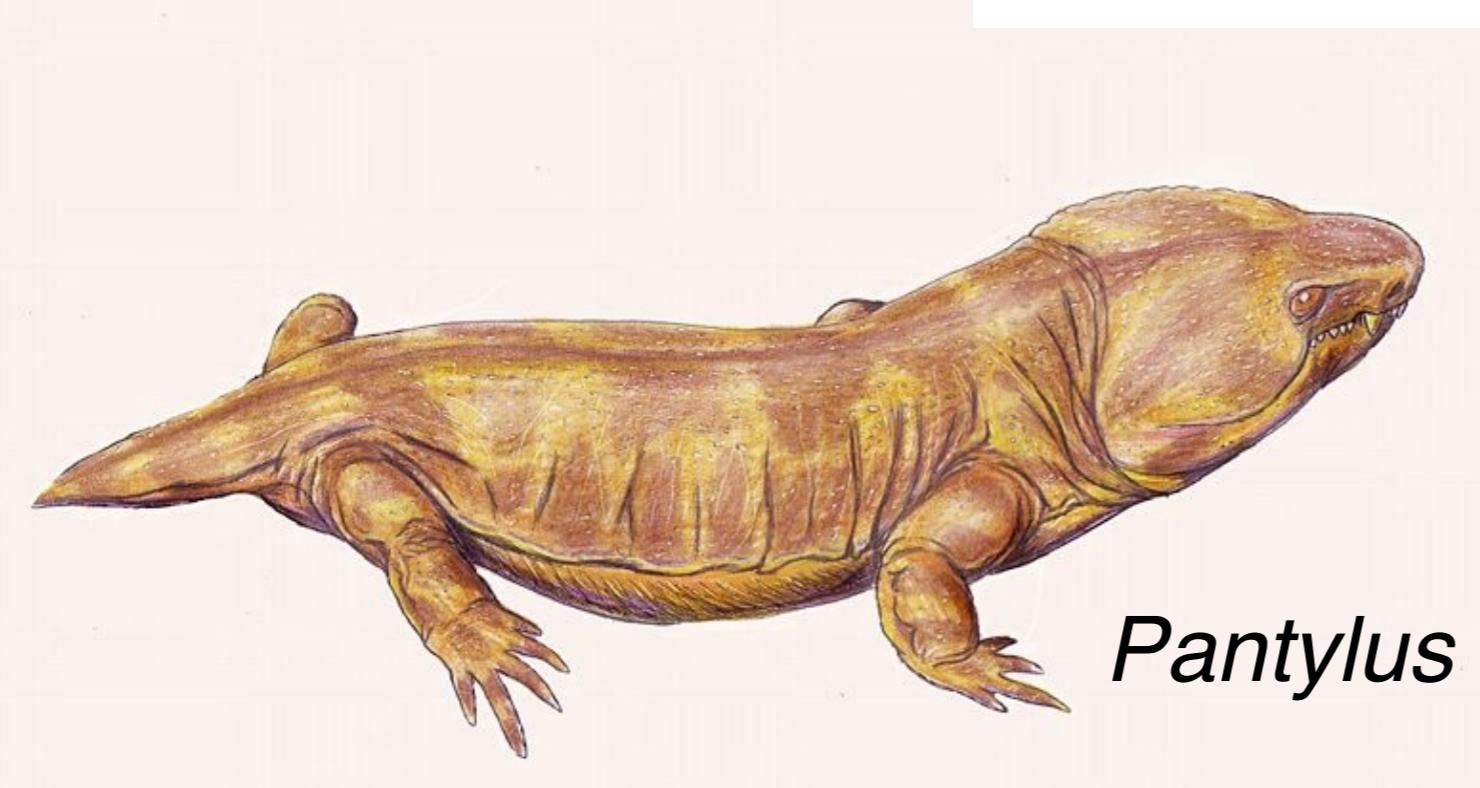
Temnospondyls

~270 mya
9 m long -
largest amphibian

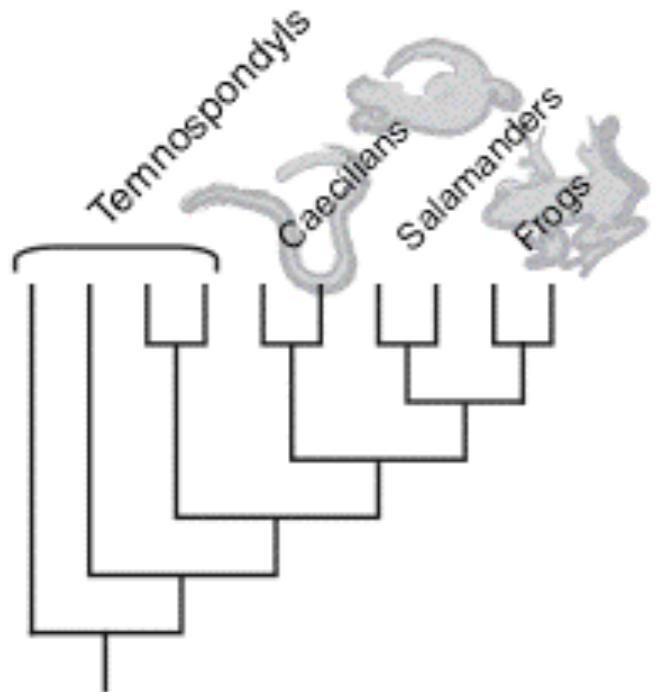
Lepospondyls



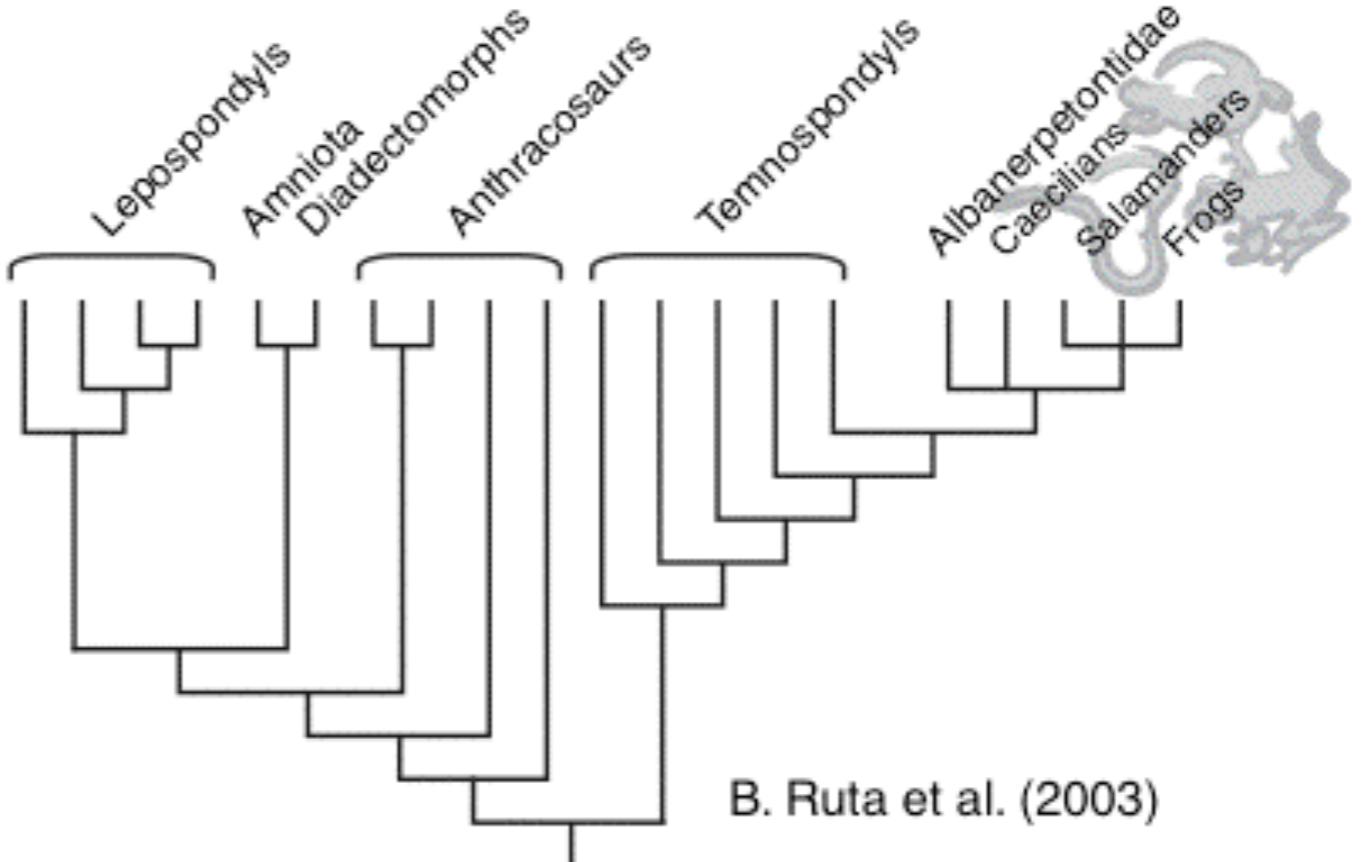
Diplocaulus



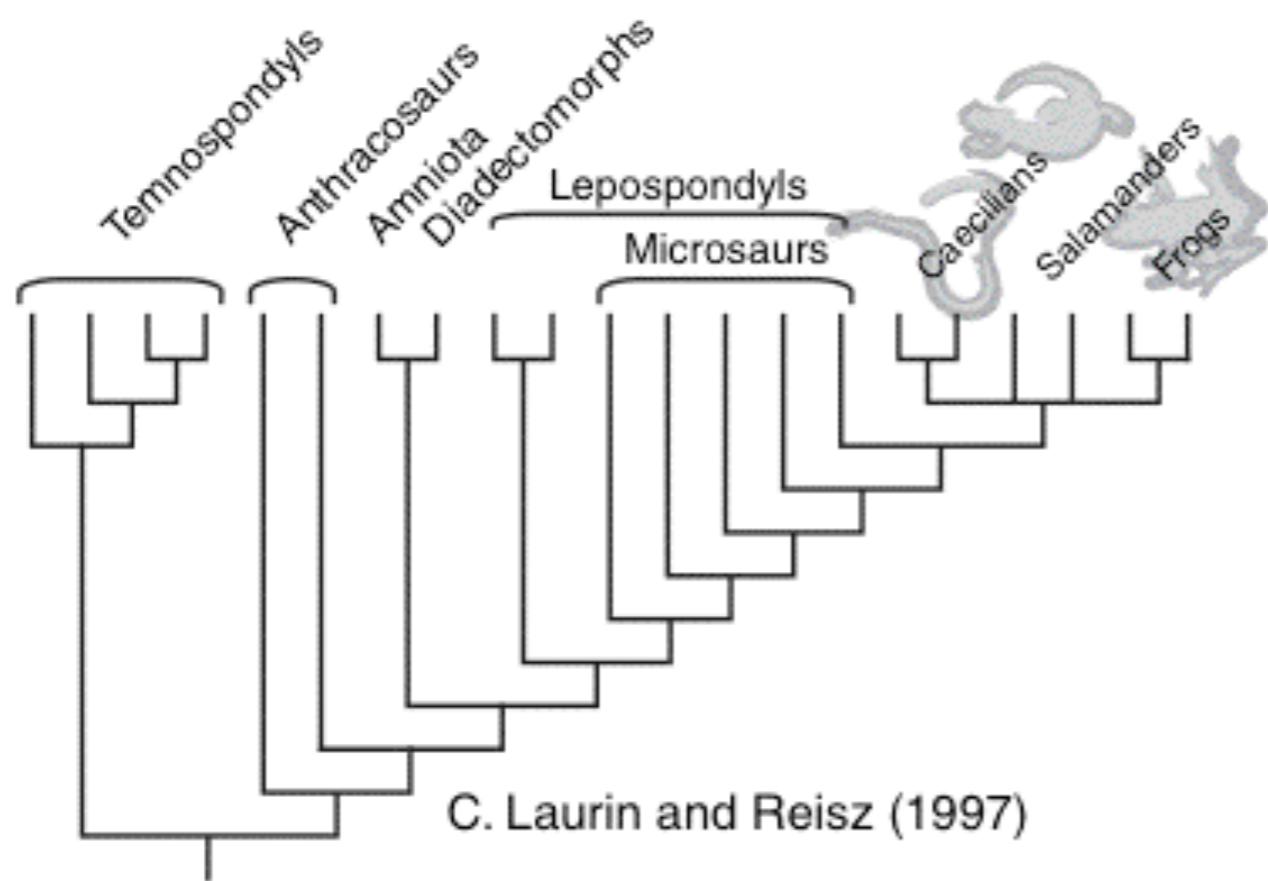
Pantylus



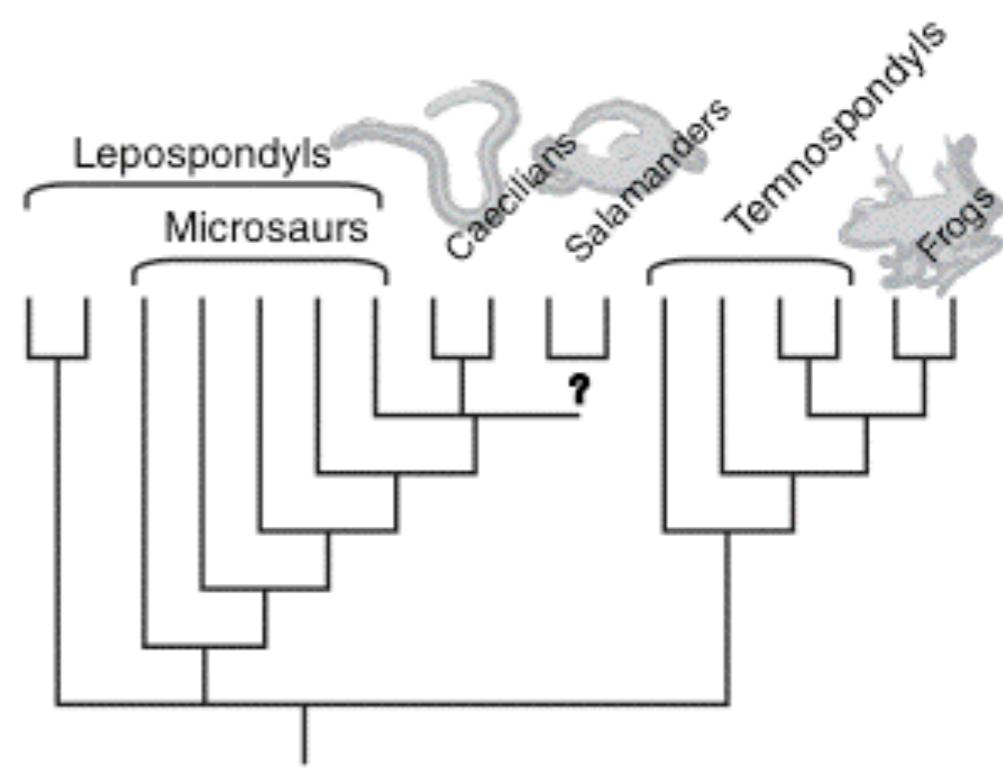
A. Trueb and Cloutier (1991)



B. Ruta et al. (2003)

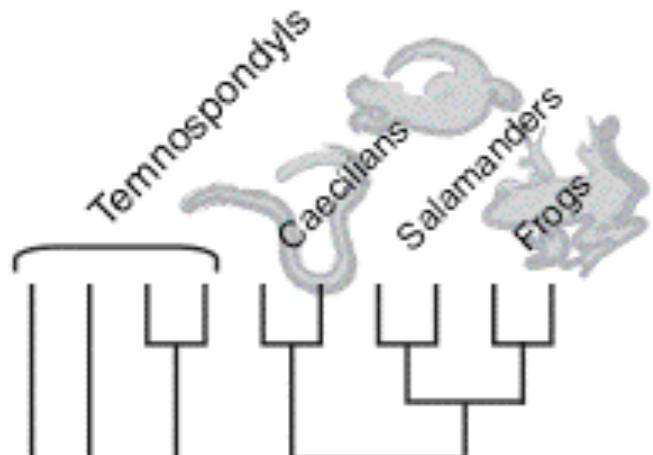


C. Laurin and Reisz (1997)

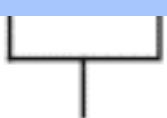


D. Carroll (2000)

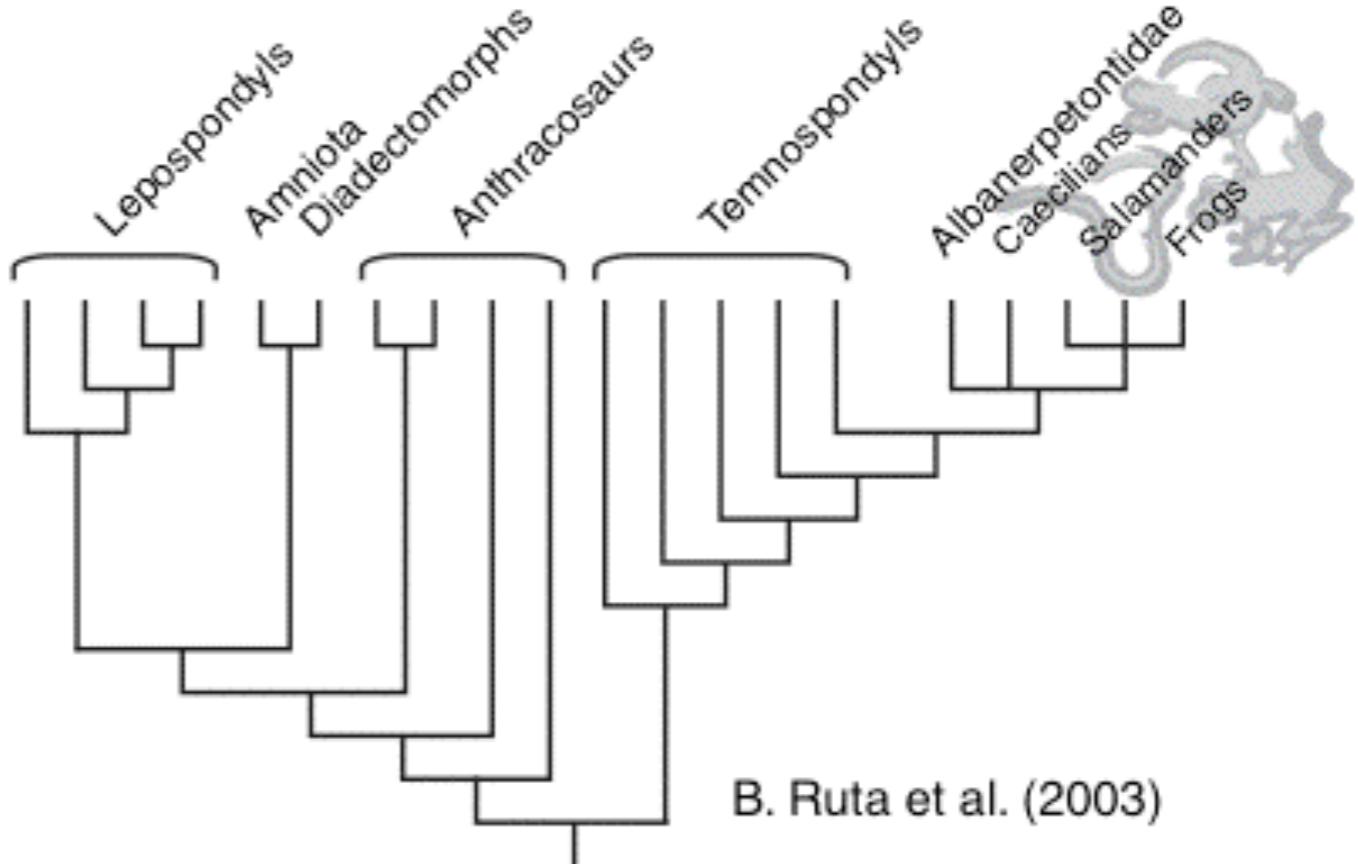
Figure 25.2. (A–D) Alternative relationships among modern amphibians (caecilians, frogs, and salamanders) and Paleozoic groups (temnospondyls, microsaurs, and lepospondyls).



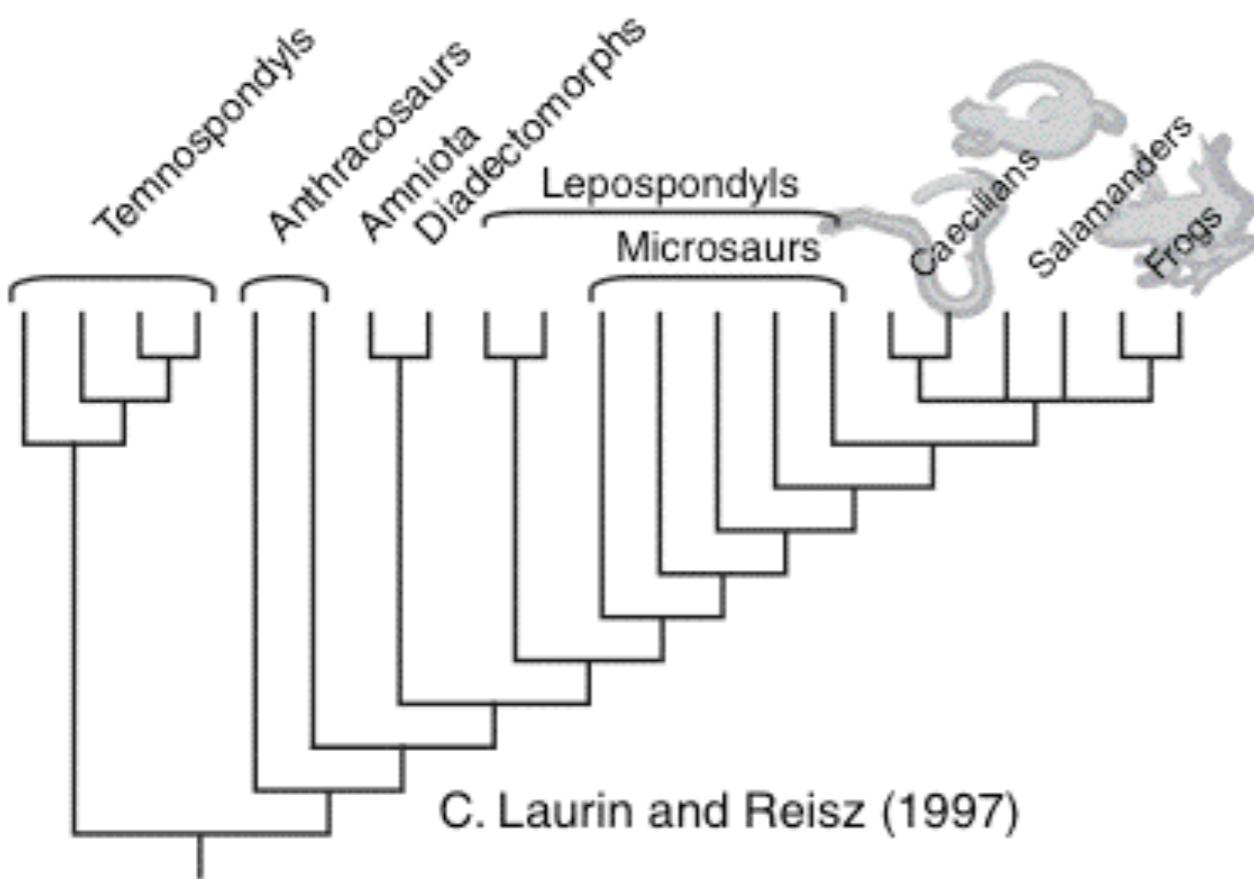
From temnospondyls



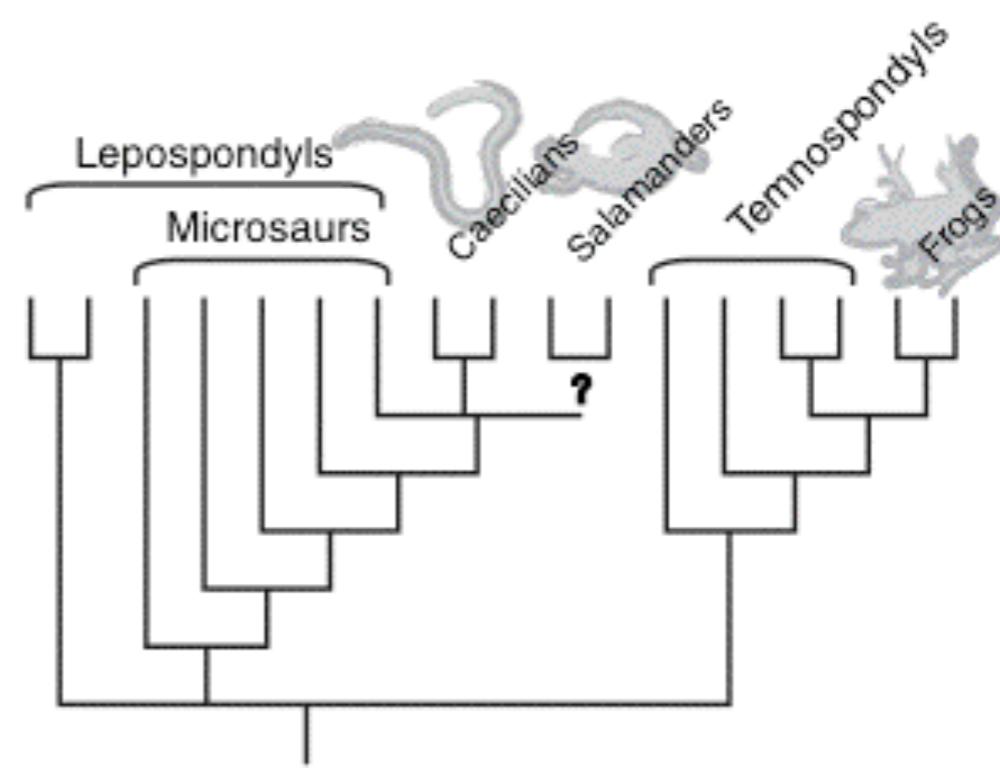
A. Trueb and Cloutier (1991)



B. Ruta et al. (2003)

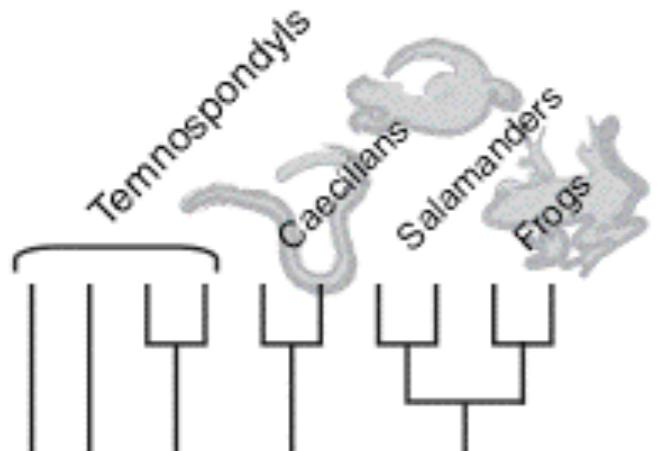


C. Laurin and Reisz (1997)

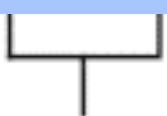


D. Carroll (2000)

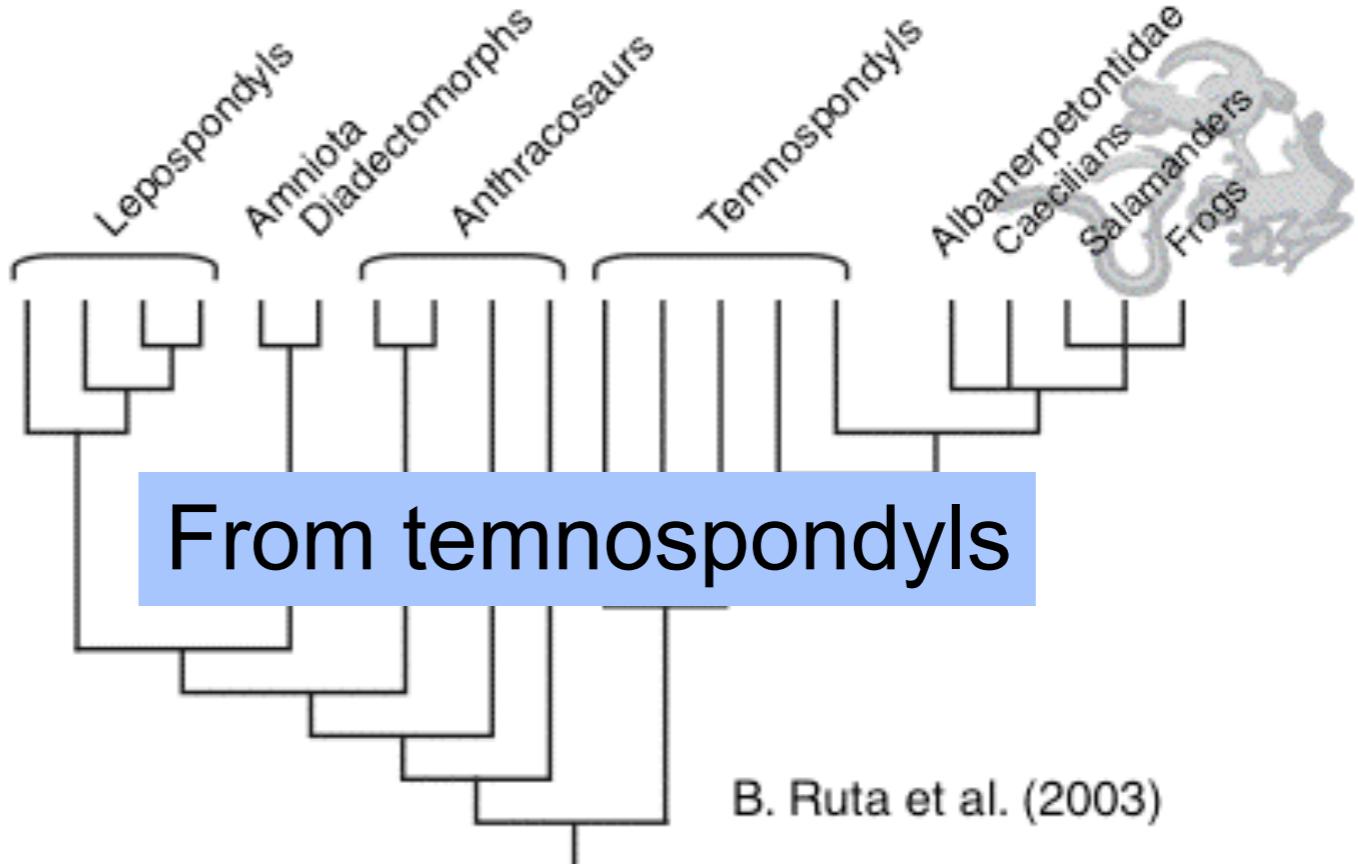
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From temnospondyls

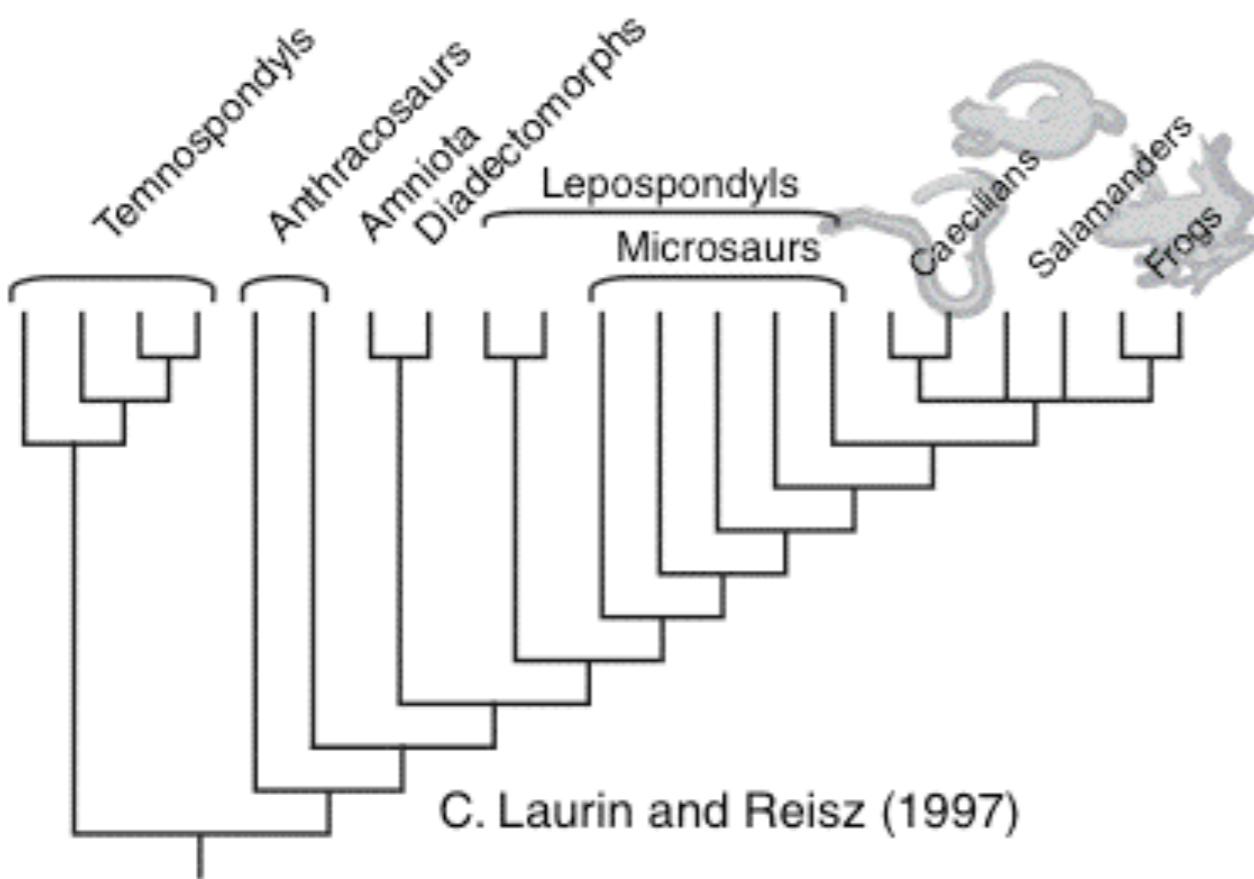


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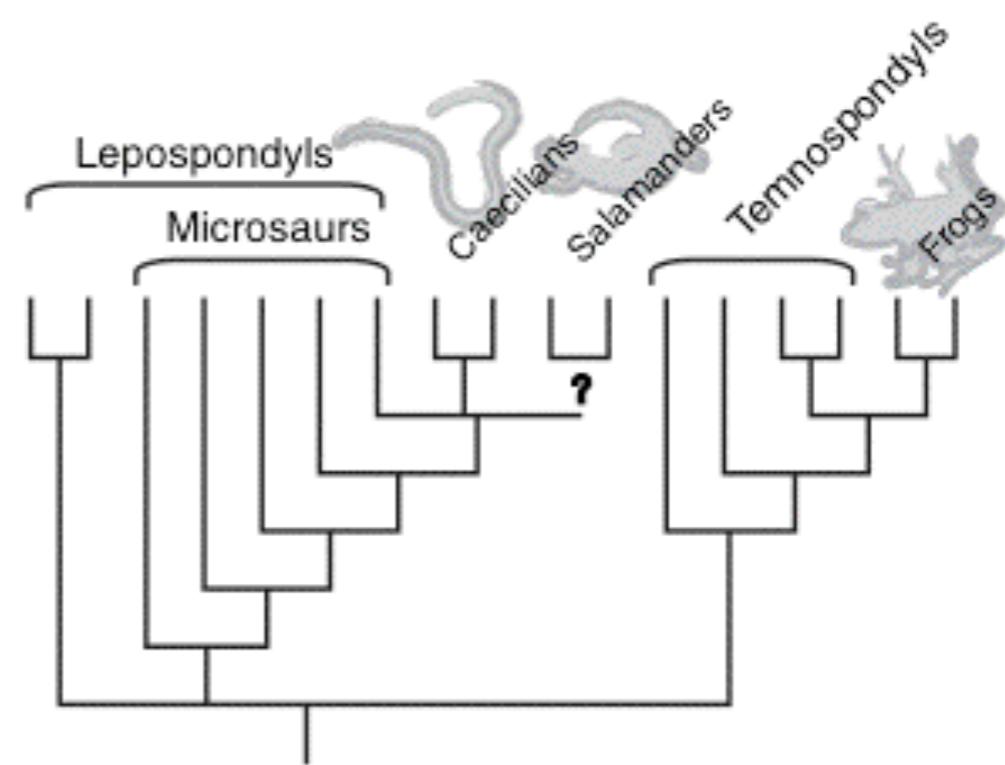


From temnospondyls

B. Ruta et al. (2003)

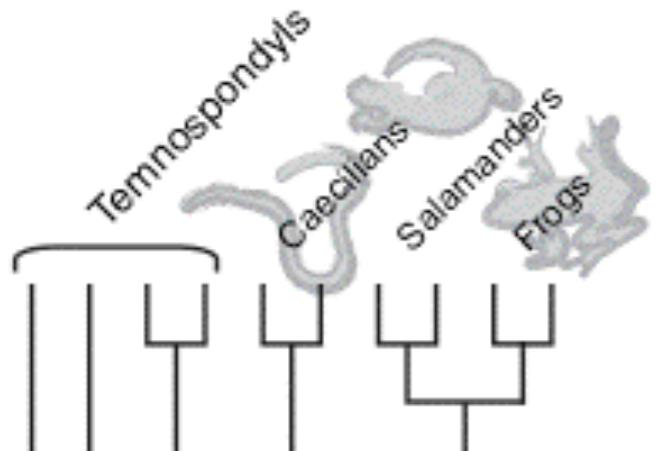


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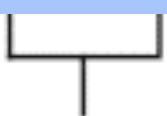


D. Carroll (2000)

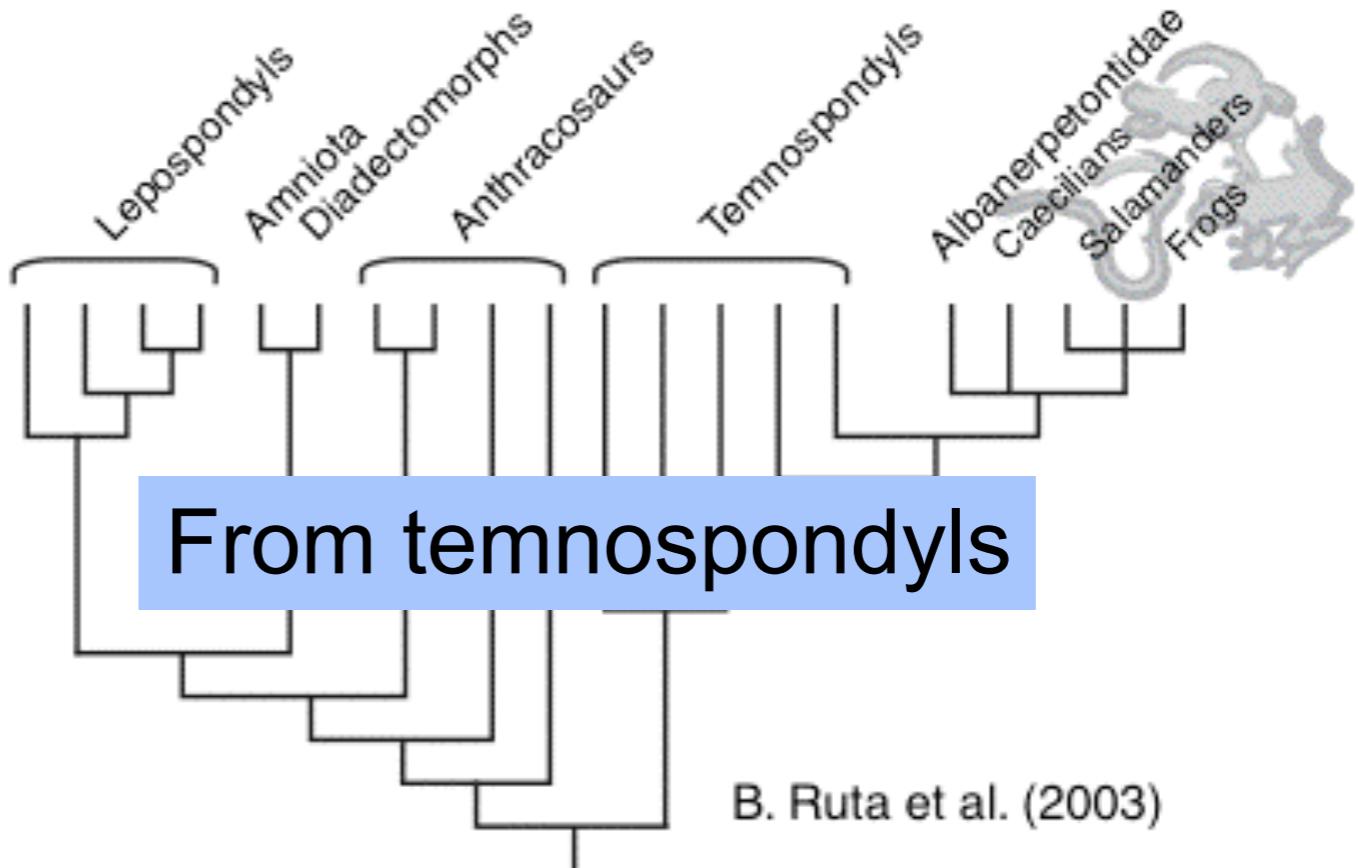
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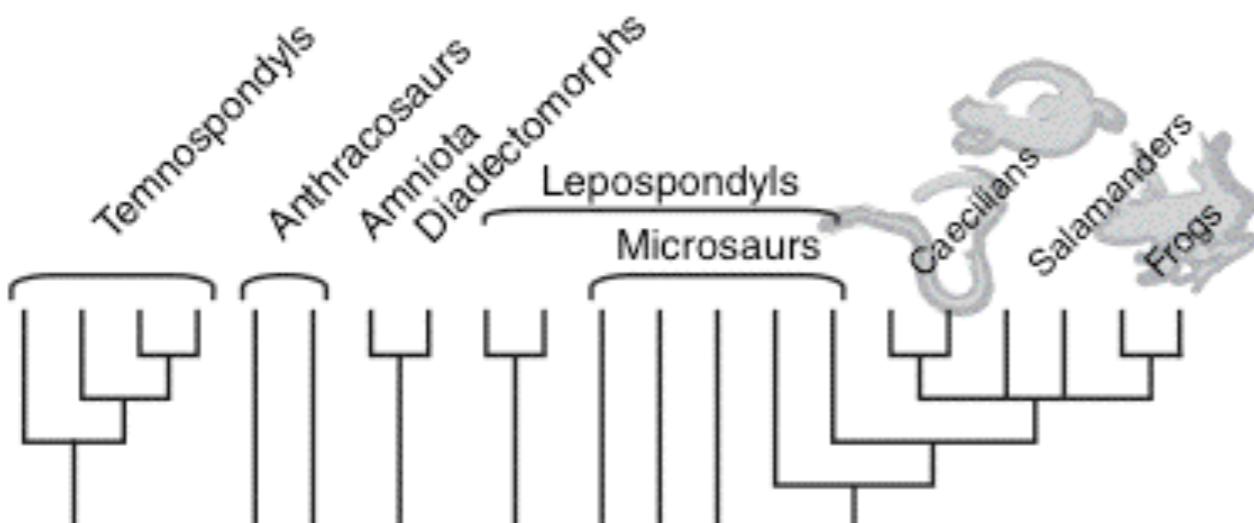


A. Trueb and Cloutier (1991)

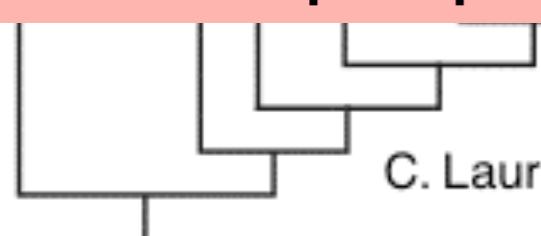


From temnospondyls

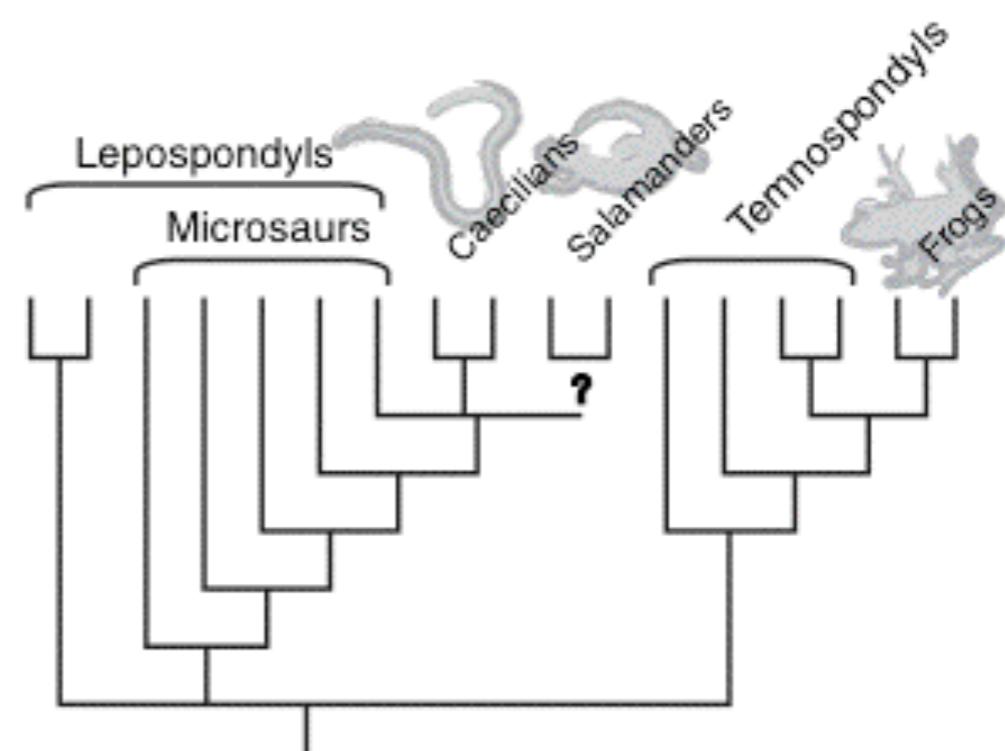
B. Ruta et al. (2003)



From lepospondyls

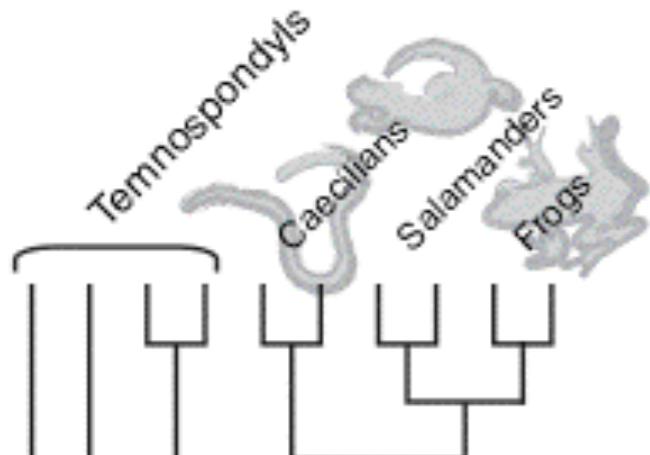


C. Laurin and Reisz (1997)

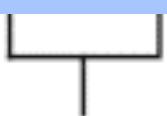


D. Carroll (2000)

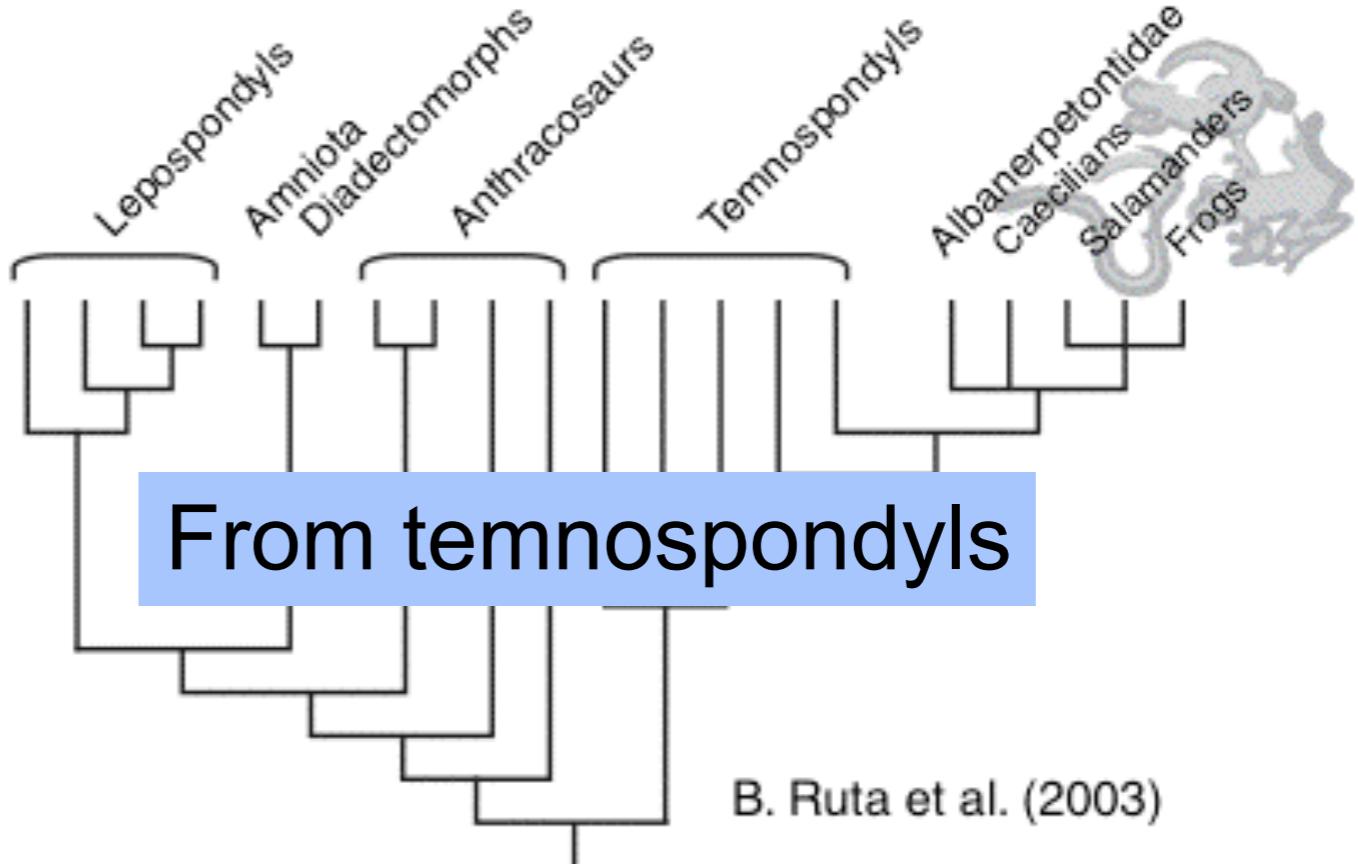
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From temnospondyls

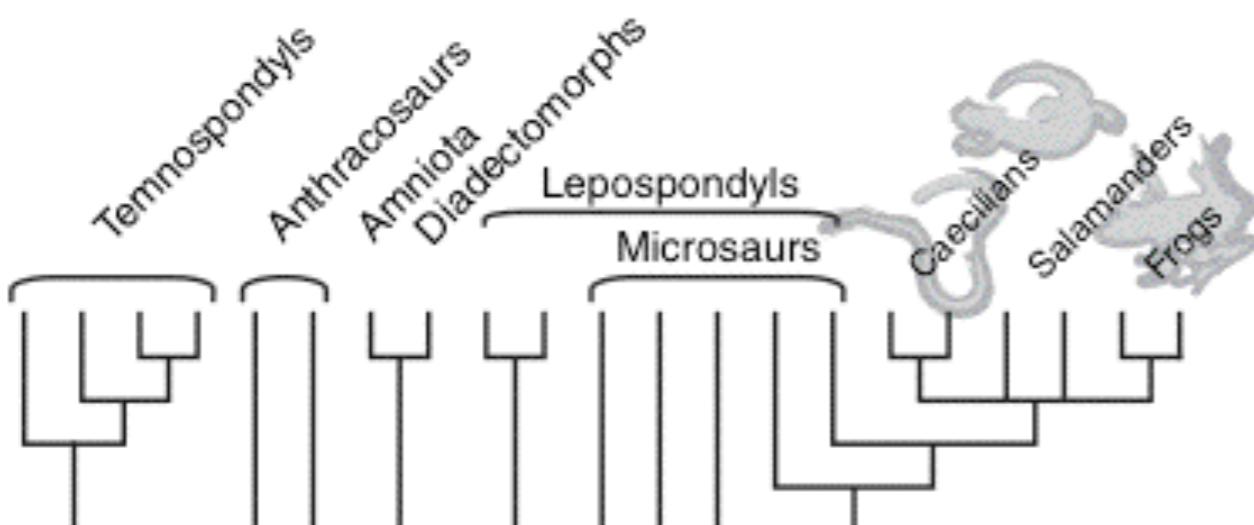


A. Trueb and Cloutier (1991)



From temnospondyls

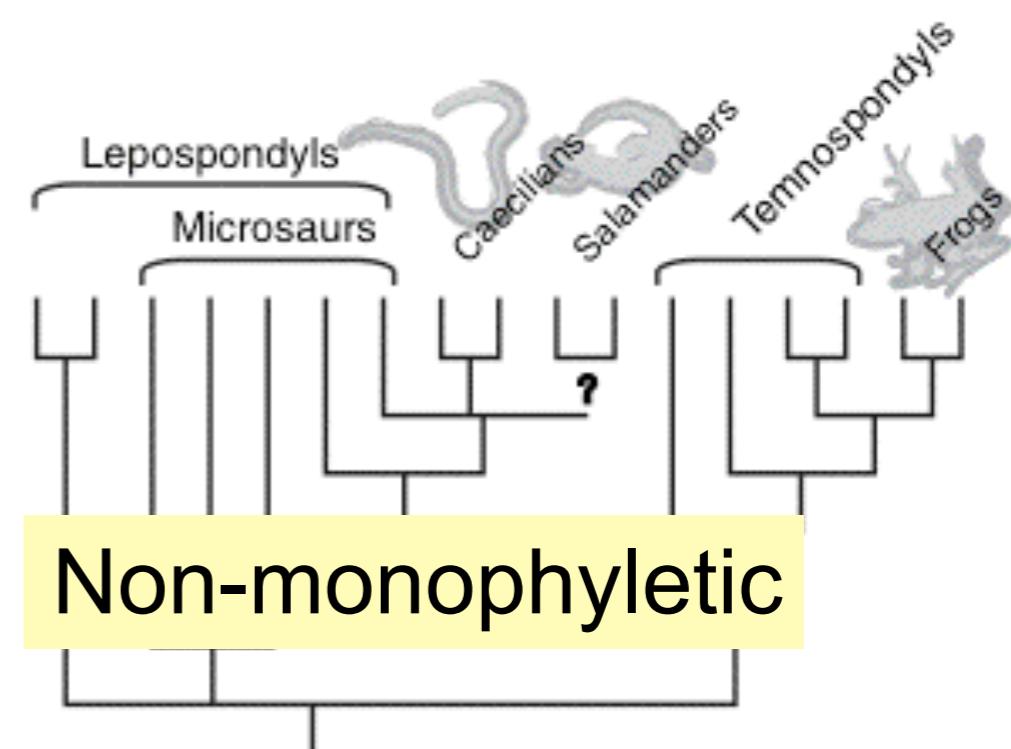
B. Ruta et al. (2003)



From lepospondyls



C. Laurin and Reisz (1997)



Non-monophyletic

D. Carroll (2000)

Figure 25.2. (A–D) Alternative relationships among modern amphibians (caecilians, frogs, and salamanders) and Paleozoic groups (temnospondyls, microsaurs, and lepospondyls).

LETTERS

A stem batrachian from the Early Permian of Texas and the origin of frogs and salamanders

Jason S. Anderson¹, Robert R. Reisz², Diane Scott², Nadia B. Fröbisch³ & Stuart S. Sumida⁴

overlying fragment of the femur. An element identified as a sacral rib

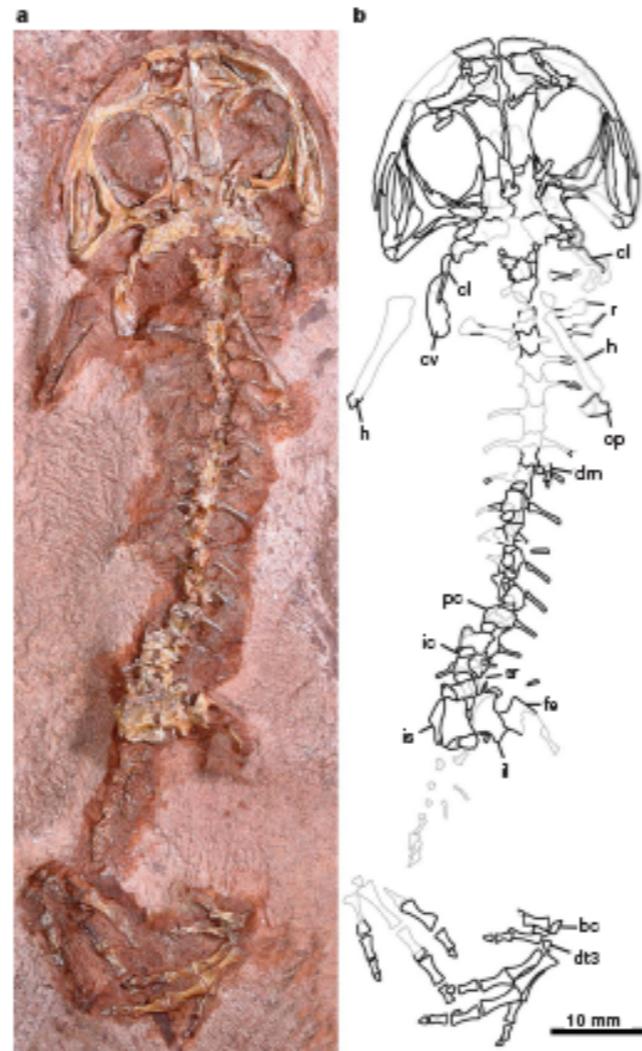


Figure 1 | *Gero batrachus hottoni*, gen. et sp. nov., holotype specimen USNM 489135. Complete specimen in ventral view, photograph (left) and interpretive outline drawing (right). Abbreviations: bc, basale commune; cl, cleithrum; cv, cleavicle; dm, digital elements of the manus; dt3, distal tar sal 3; fe, femur; h, humerus; ic, intercentrum; il, ilium; is, ischium; op, olecranon process of ulna; pc, pleuronectrum; r, radius; sr, sacral rib.

articulate with the proximal surfaces of metatarsals 1 and 2, it would

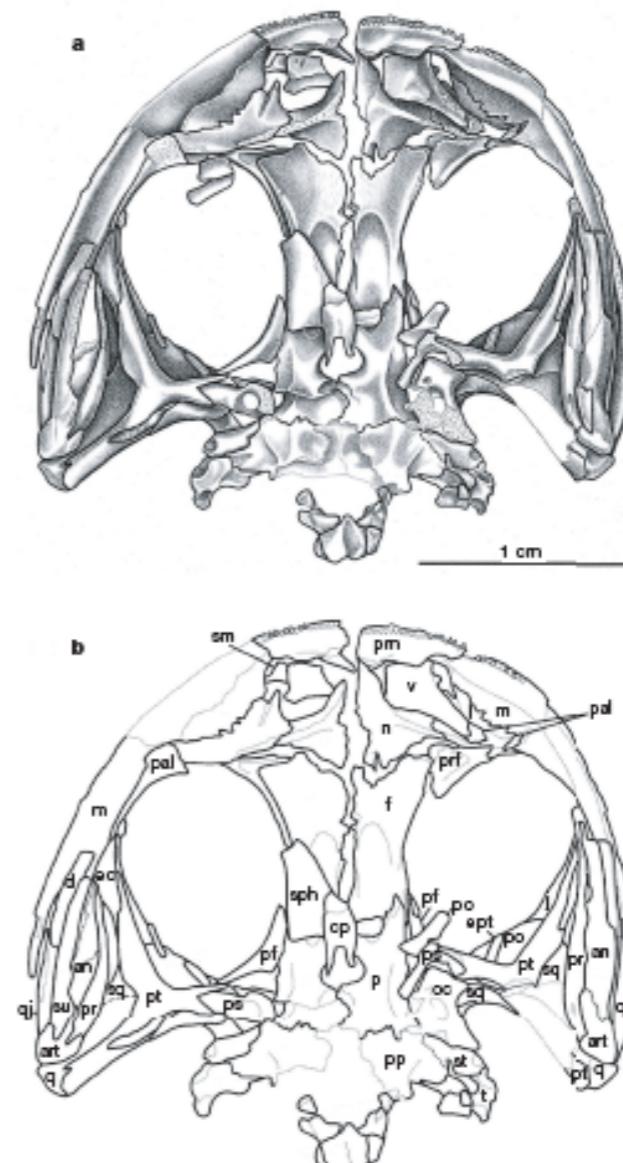


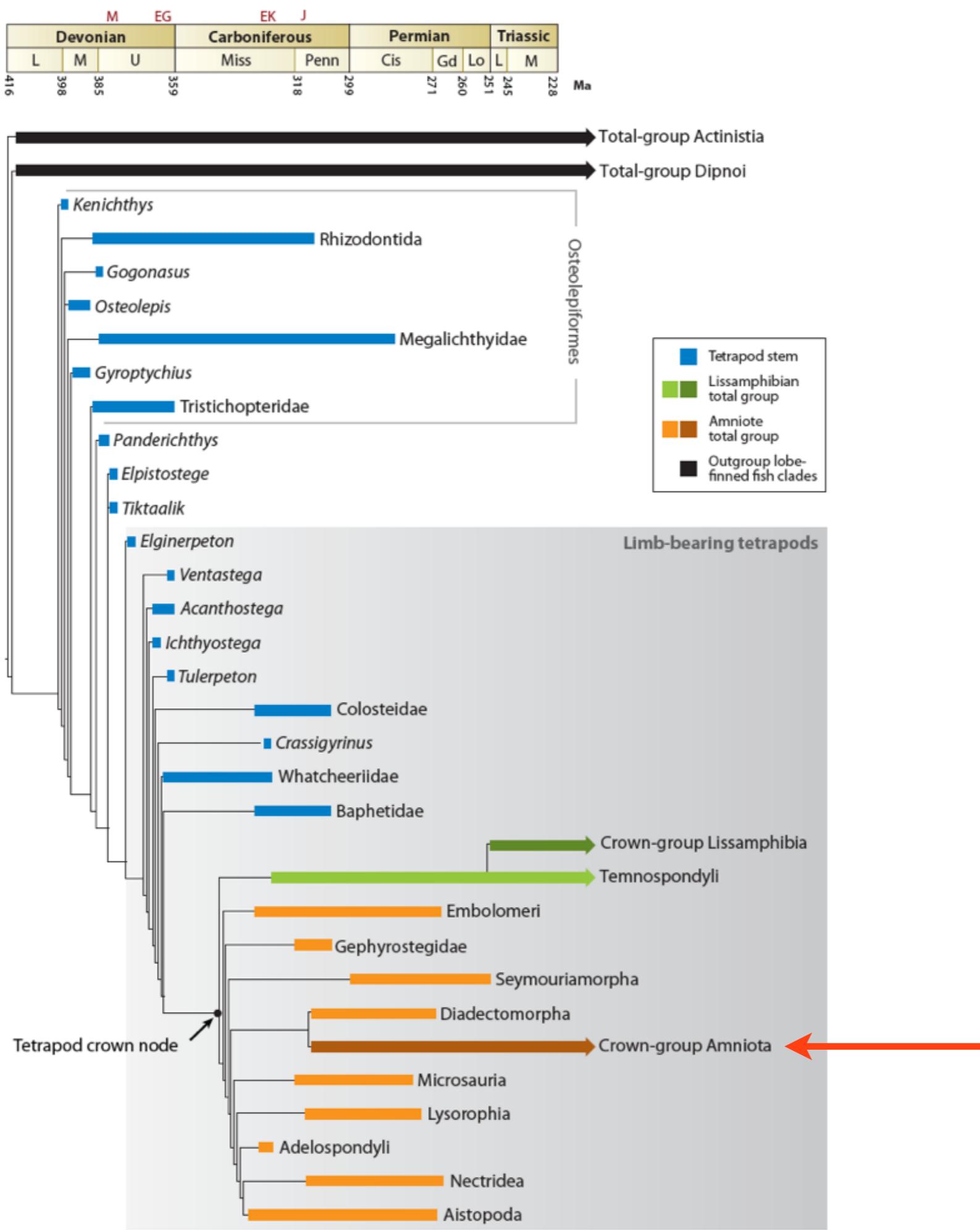
Figure 2 | Gerobatrachus hottoni, gen. et sp. nov., holotype specimen USNM 489135. a, Close-up interpretive specimen, and b, outline drawing of skull in ventral view. Abbreviations are the same as for Fig. 1 and: an, angular; art, articular; cp, cultriform process of parasphenoid; d, dentary; ec, ectopterygoid; ept, epipterygoid; f, frontal; j, jugal; l, lacrimal; m, maxilla; n, nasal; oc, portion of otic capsule; p, parietal; pal, palatine; pf, postfrontal; pm, premaxilla; po, postorbital; pp, postparietal; pr, prearticular; prf, prefrontal; ps, parasphenoid; pt, pterygoid; q, quadrate; qj, quadratejugal; sm, septomaxilla; sph, spheneithmoid; sq, squamosal; st, supratemporal; su, surangular; t, tabular; v, vomer.

Anderson et al. 2008

Gerobatrachus:
The “frogamander”

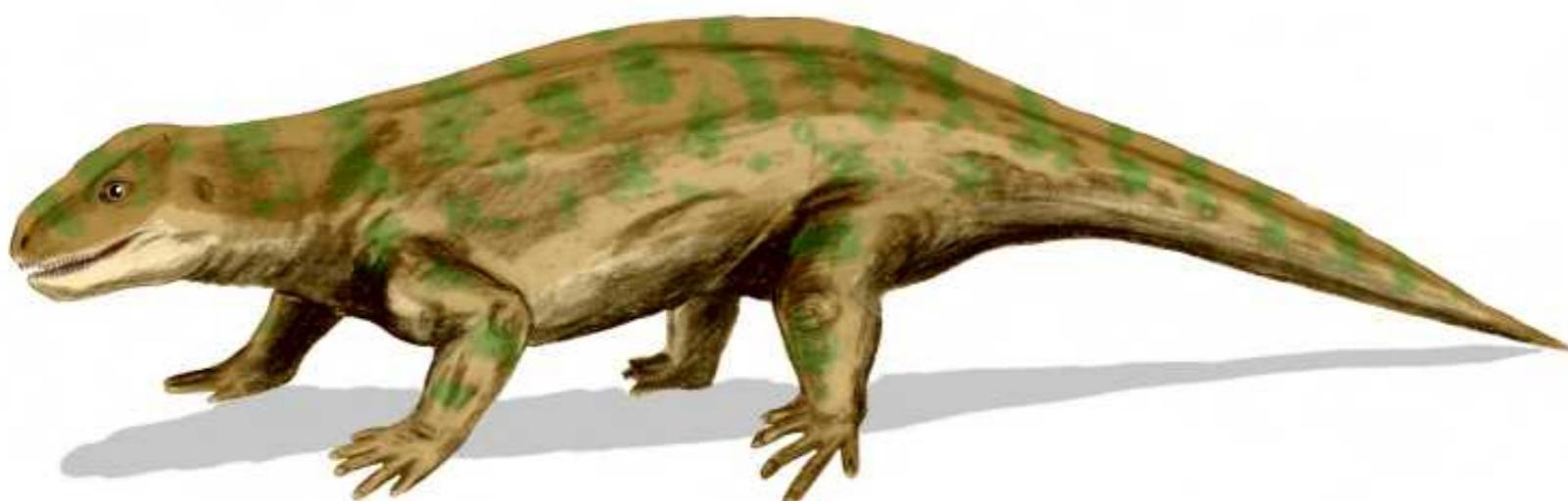


Art by Michael Skrepnick



Early Evolution in Amniotes

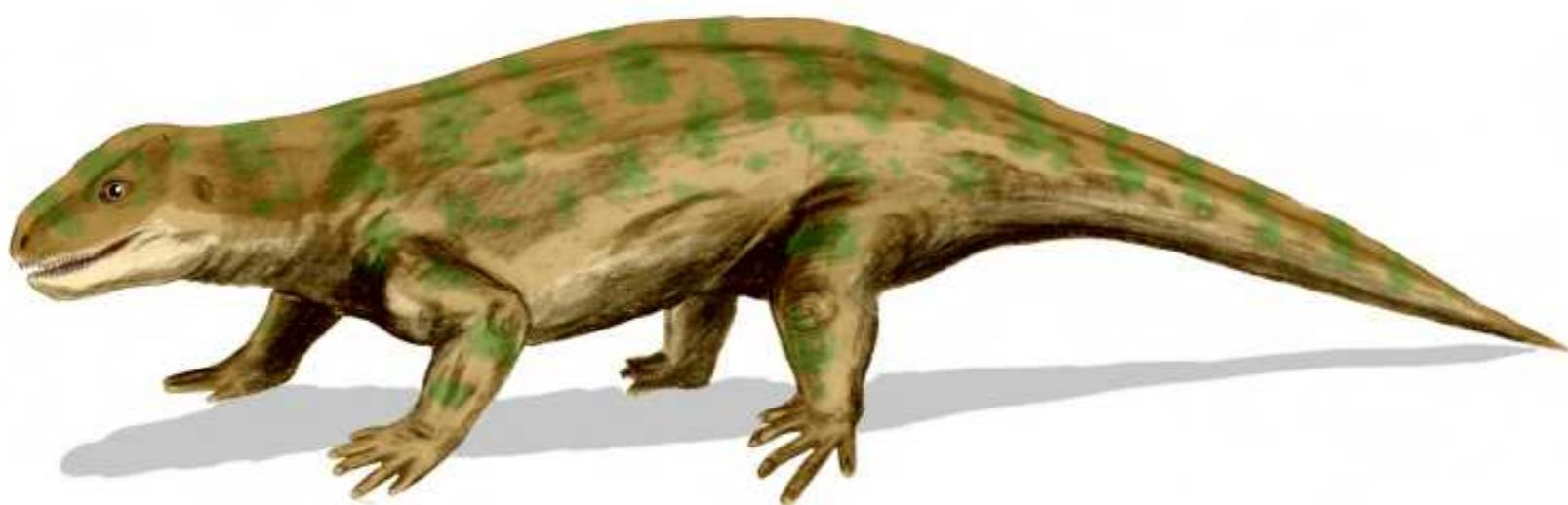
- Amniota derives from the possession of an amniotic egg
- Sister group to amniotes: *Diadectomorpha*



Diadectes, from wikipedia

Early Evolution in Amniotes

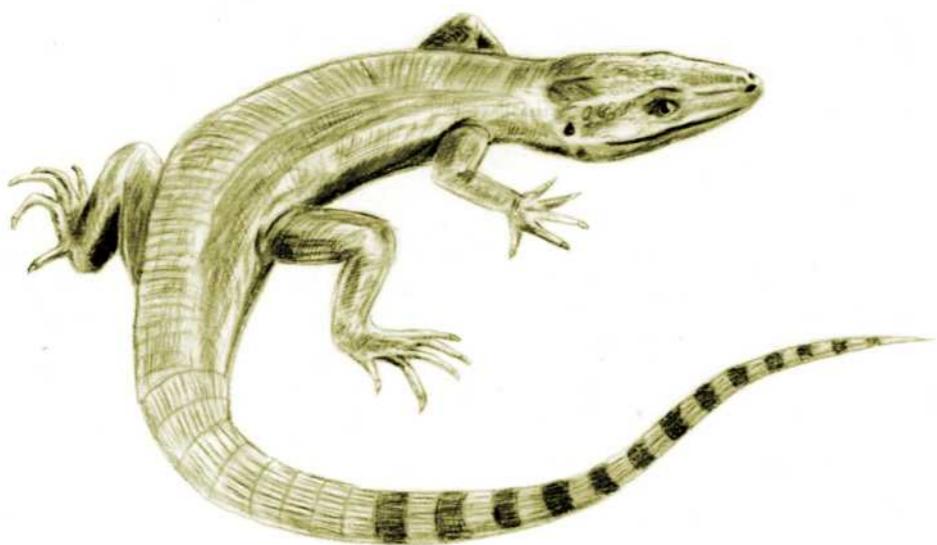
- A large number of derived traits are shared by didactomorphs and amniotes
- Soon after, there is a major split in the amniotes



Diadectes, from wikipedia

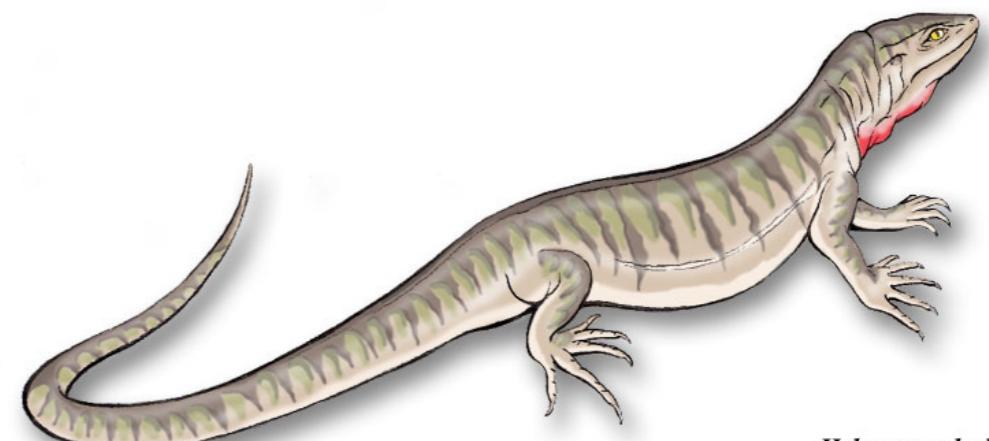
Division in the amniotes

Synapsids



Archaeothyris,
an early synapsid

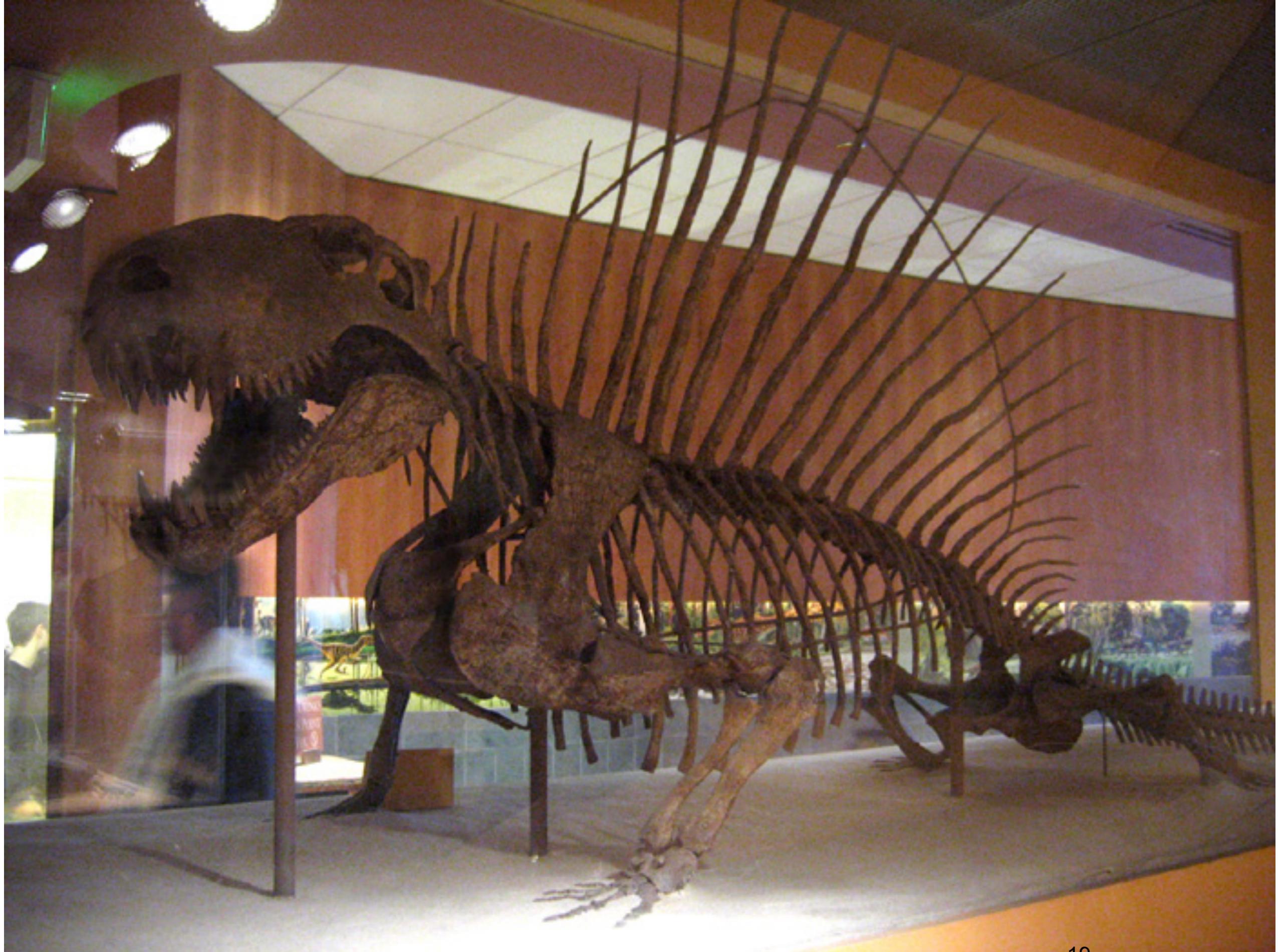
Reptiles



Hylonomus lyelli

Illustration by Donald Agnew
Joggins Fossil Cliffs Project - CREDA

Hylonomus,
an early reptile



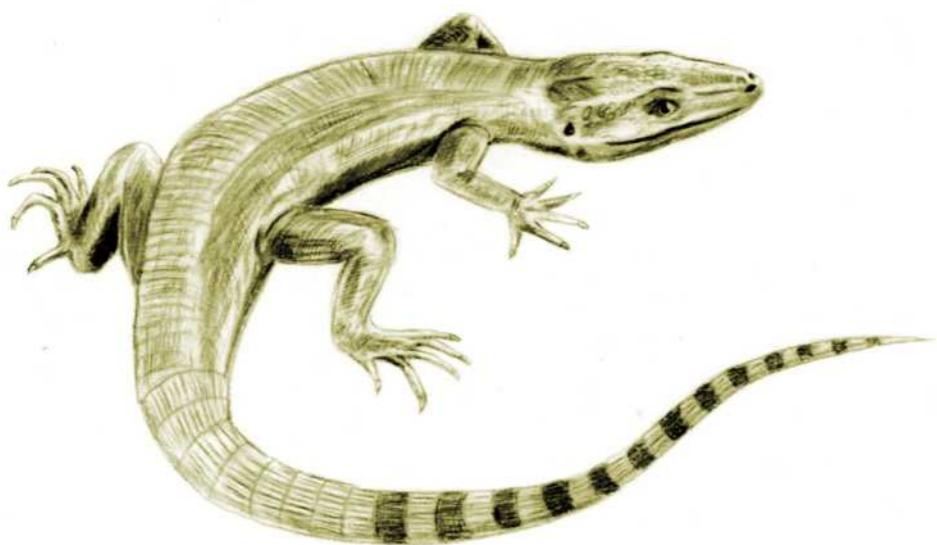
Fossil skeleton of *Dimetrodon grandis*, National Museum of Natural History, Washington, DC.



Cynognathus

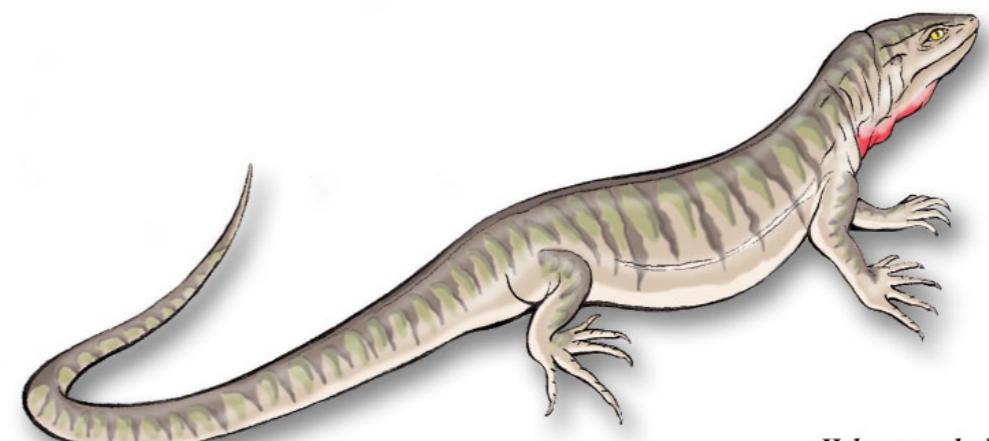
Division in the amniotes

Synapsids



Archaeothyris,
an early synapsid

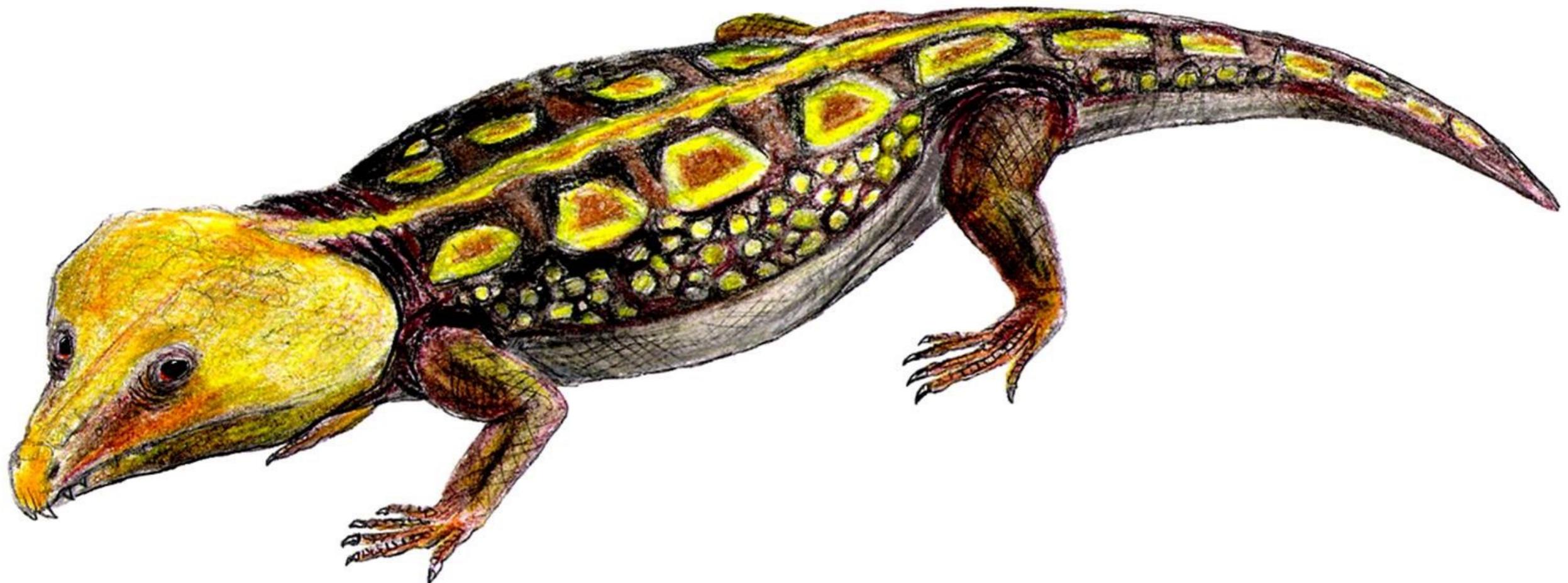
Reptiles



Hylonomus lyelli

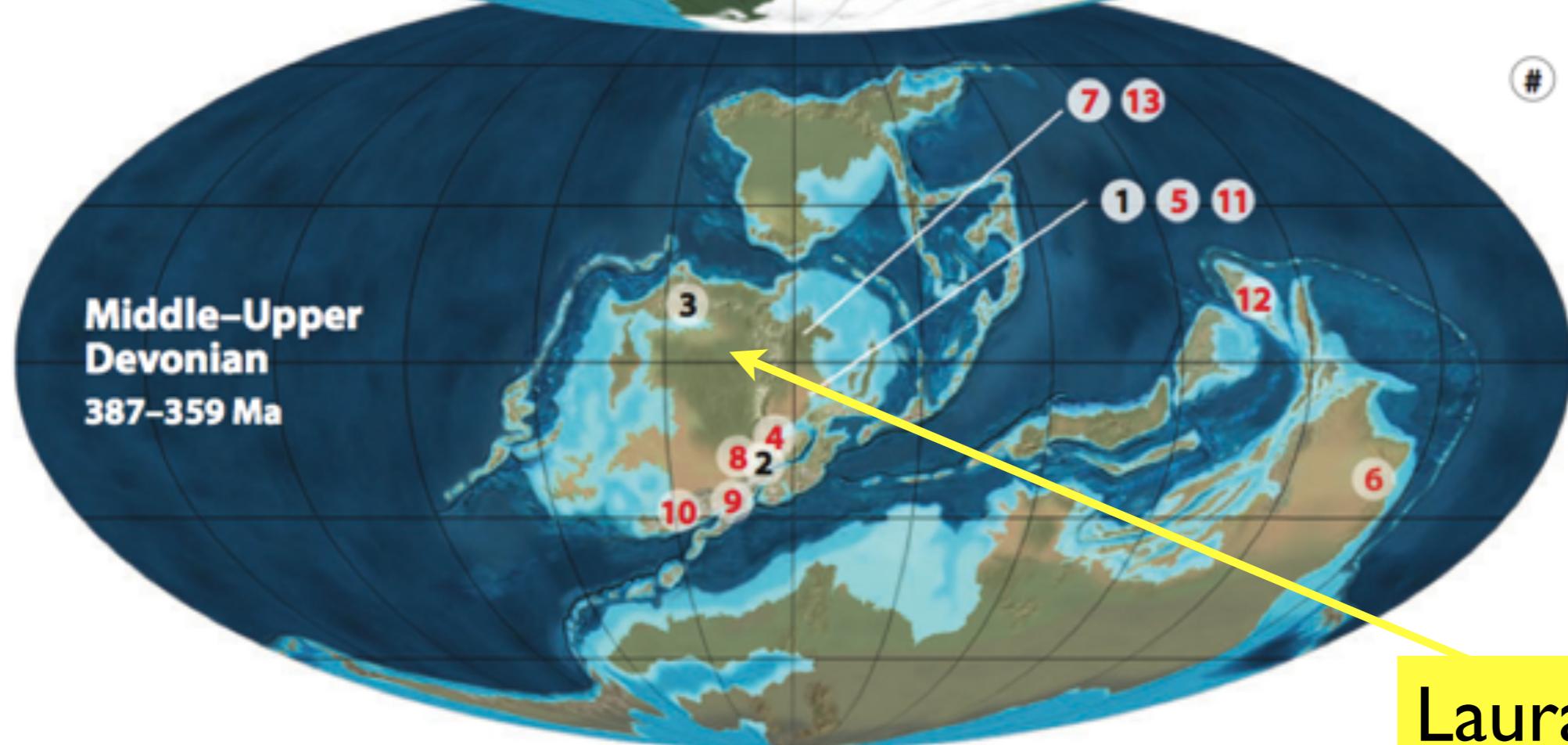
Illustration by Donald Agnew
Joggins Fossil Cliffs Project - CREDA

Hylonomus,
an early reptile



Labidosaurus hamatus.

Where did this all take place?



Sites yielding elpistostegalian-grade taxa

Sites yielding taxa known or believed to be limb bearing

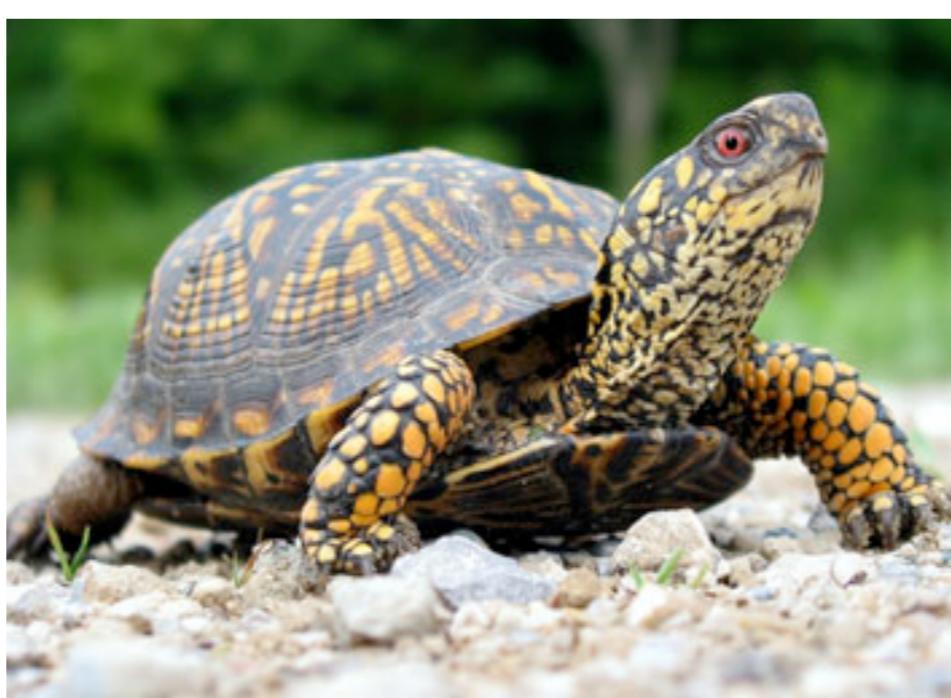
Devonian



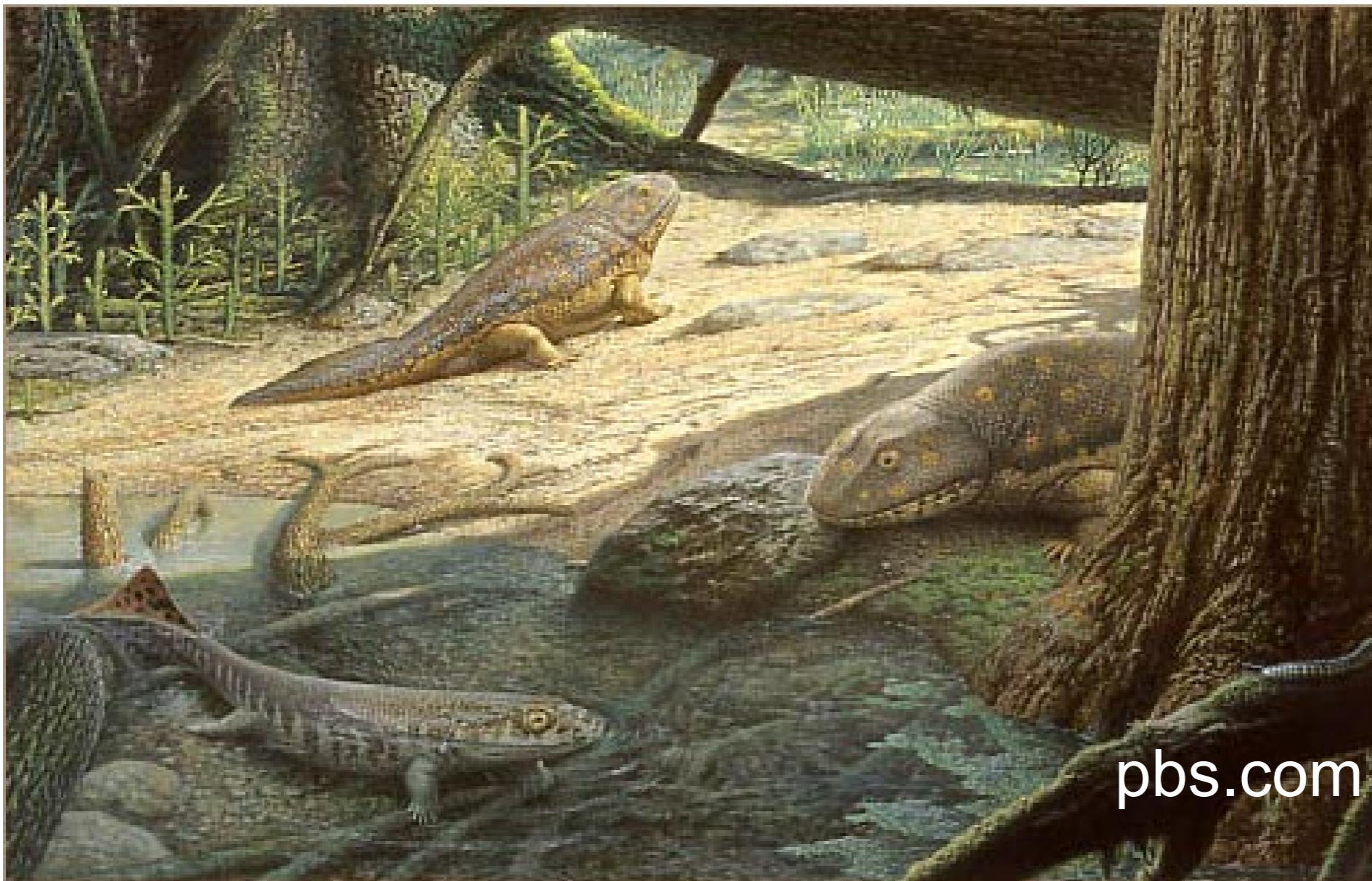
Carboniferous



"Eryops in Carboniferous swamp"
Copyright © Walter Myers
<http://www.arcadastreet.com>

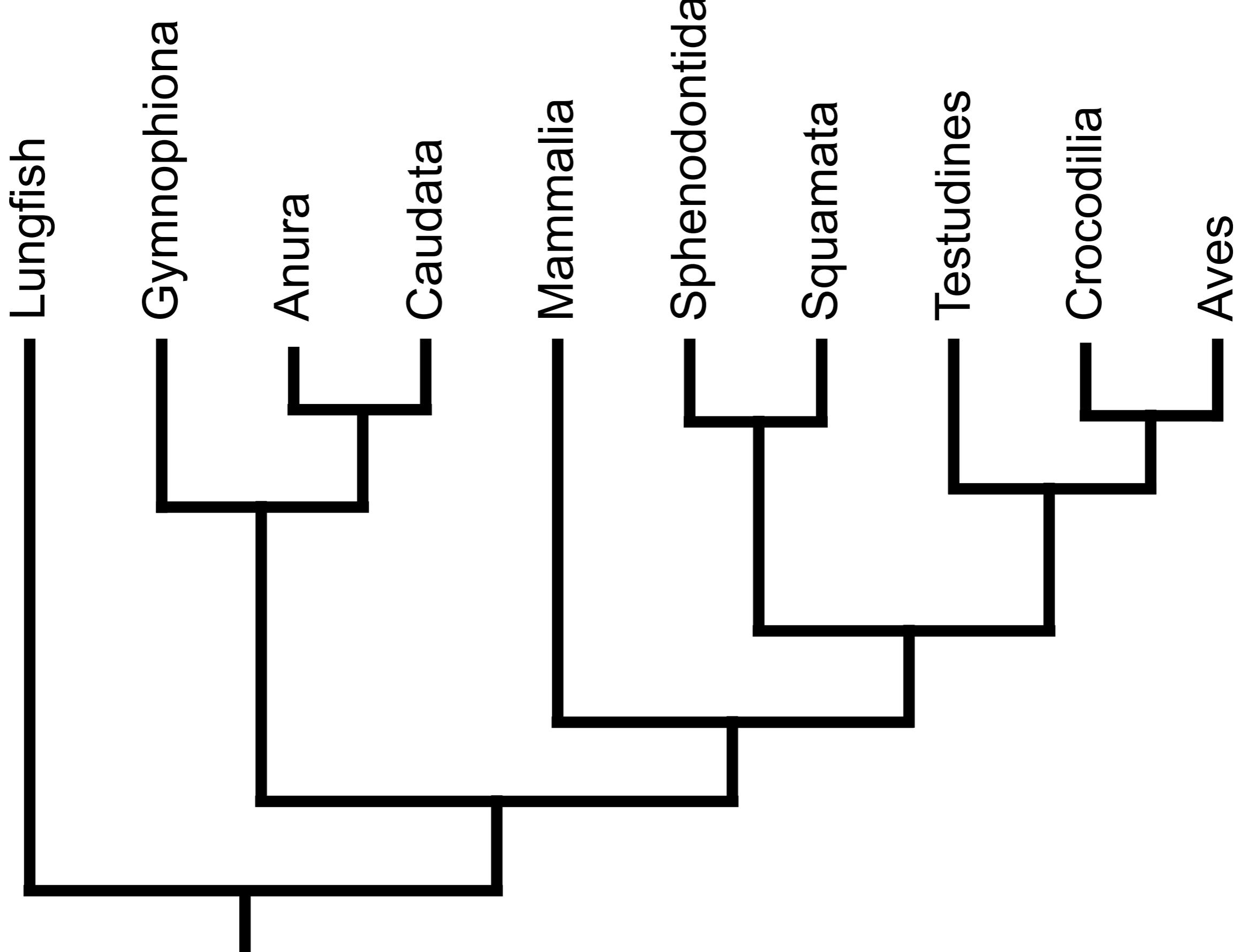


Overview of tetrapod diversity

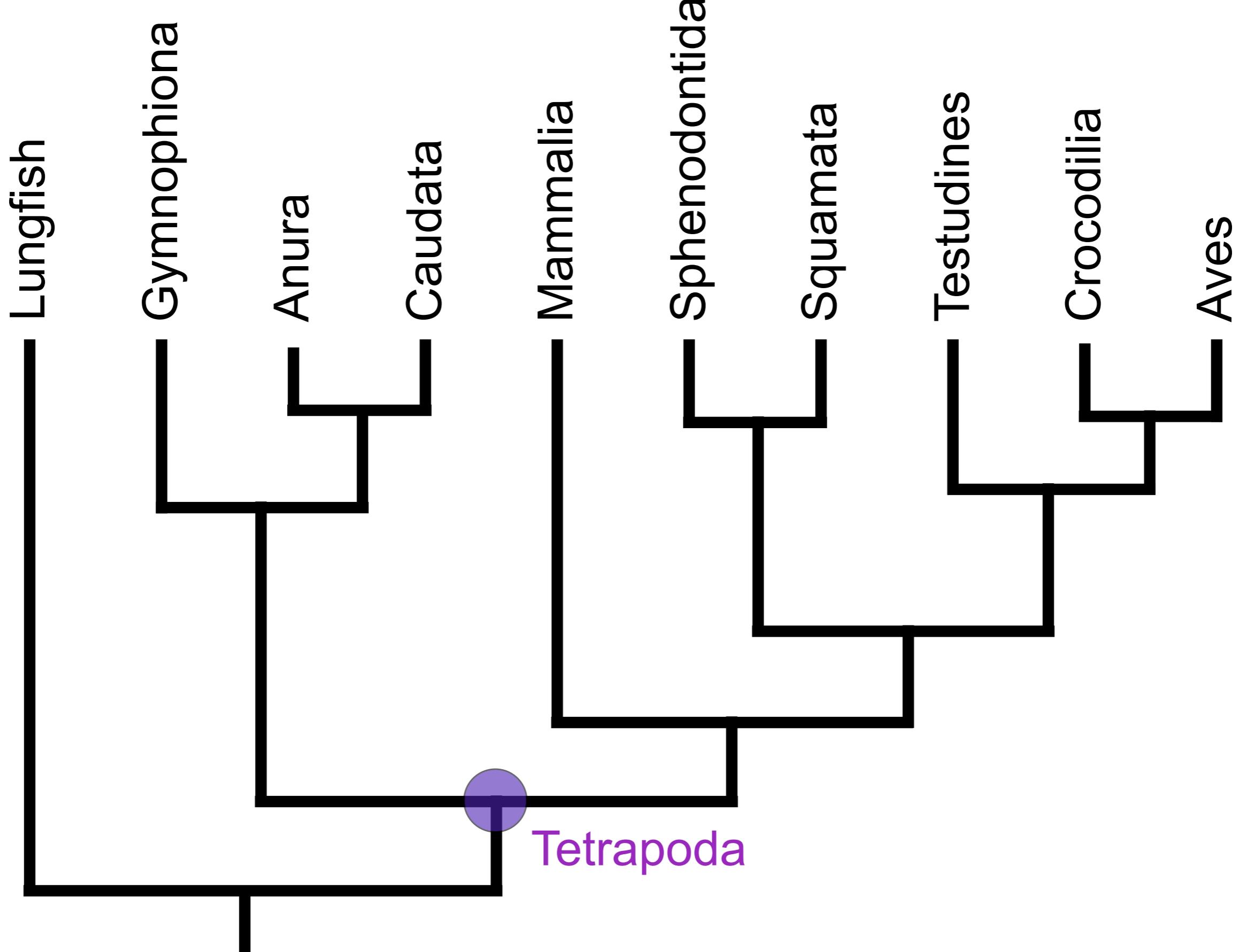


pbs.com

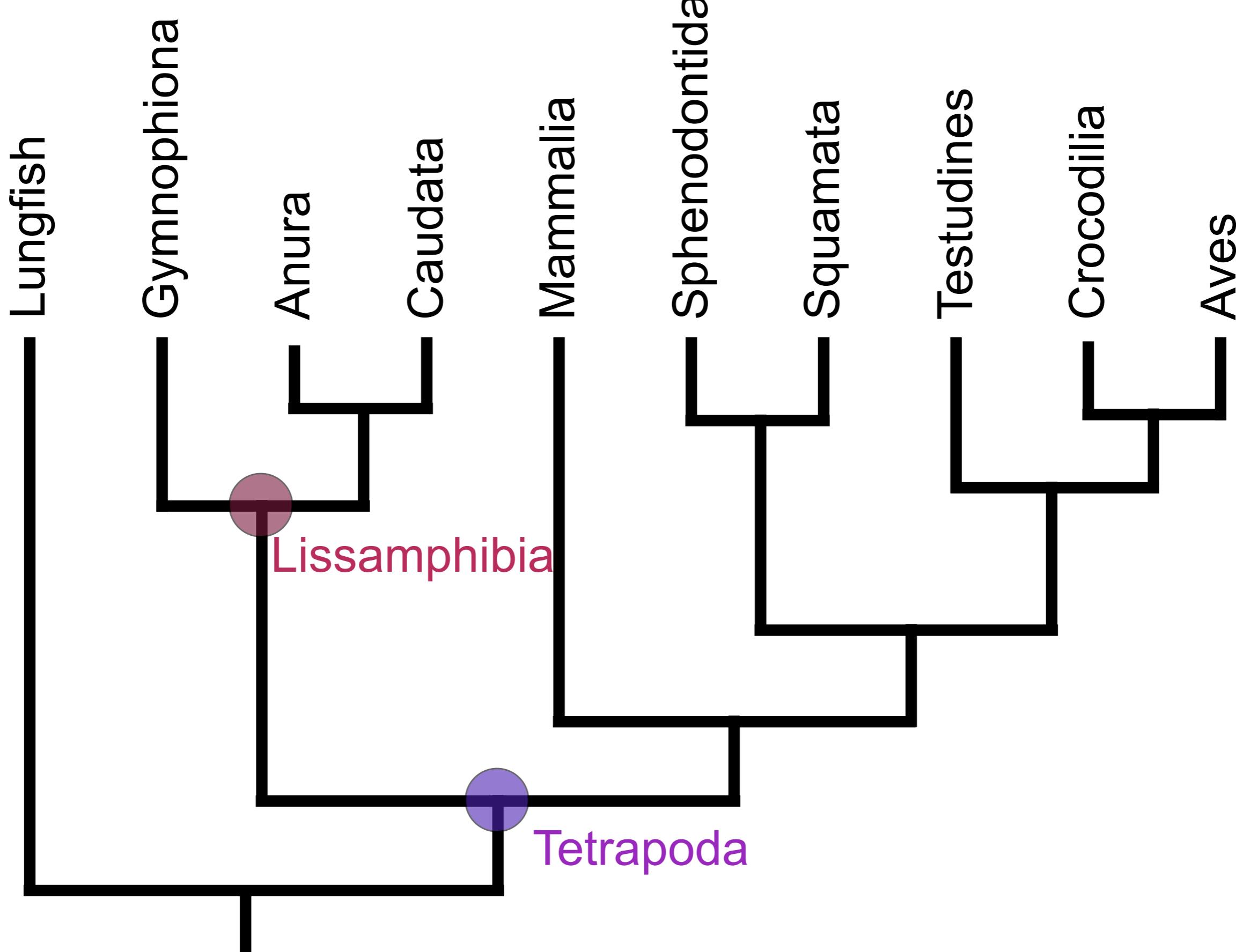
Systematics of living “herps”



Systematics of living “herps”

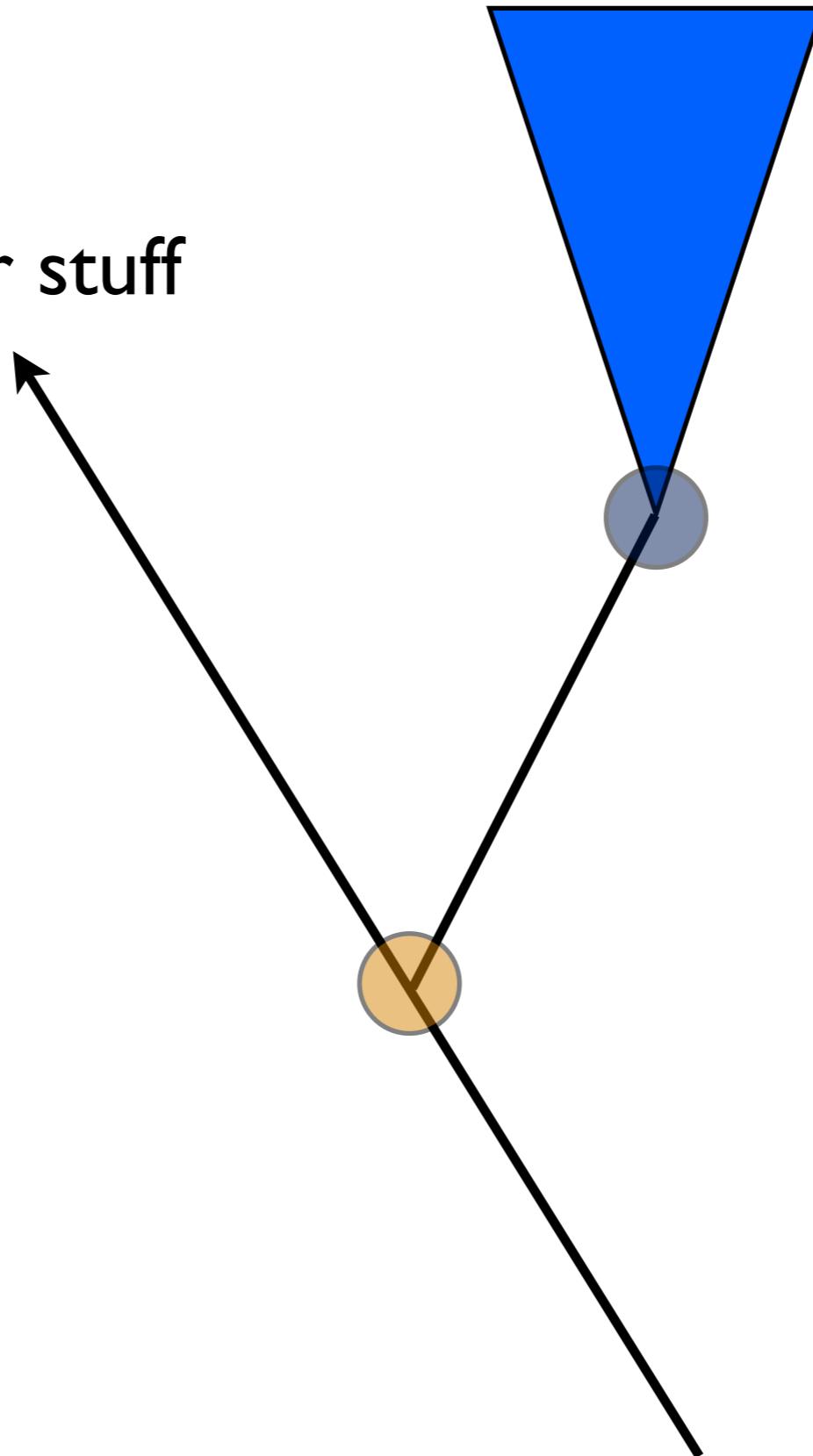


Systematics of living “herps”



living
amphibians

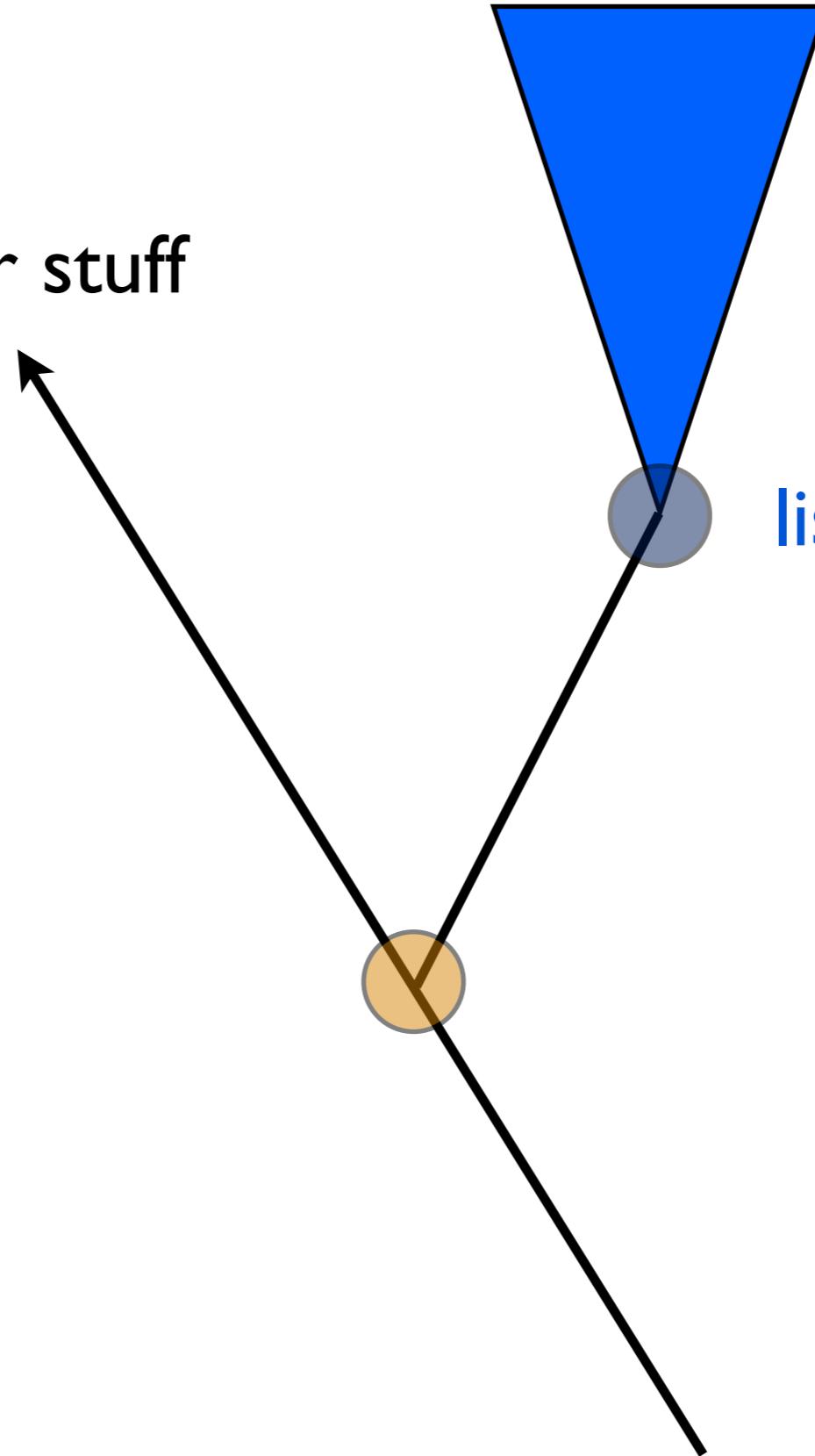
other stuff



living
amphibians

other stuff

lissamphibia

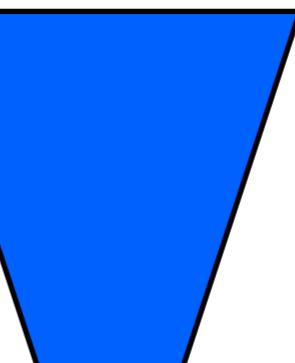


living
amphibians

other stuff



amphibia



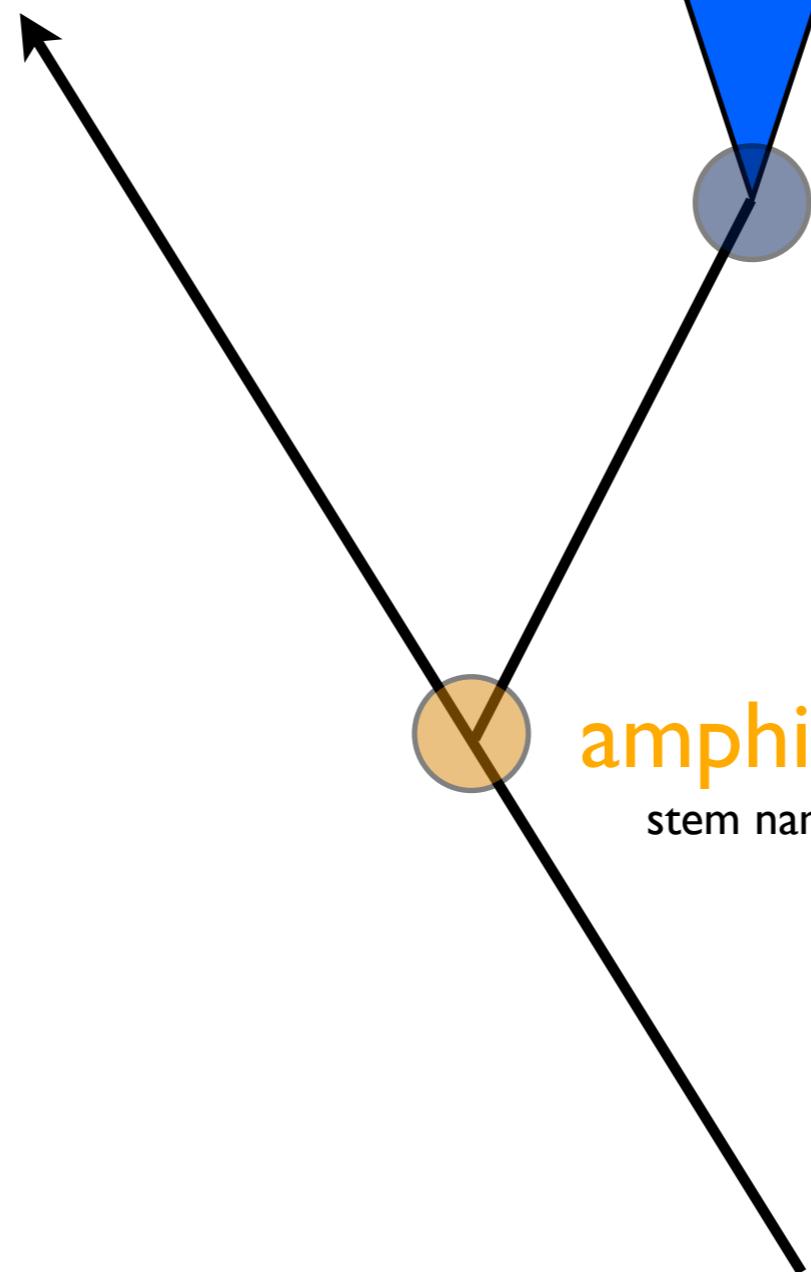
lissamphibia

living
amphibians

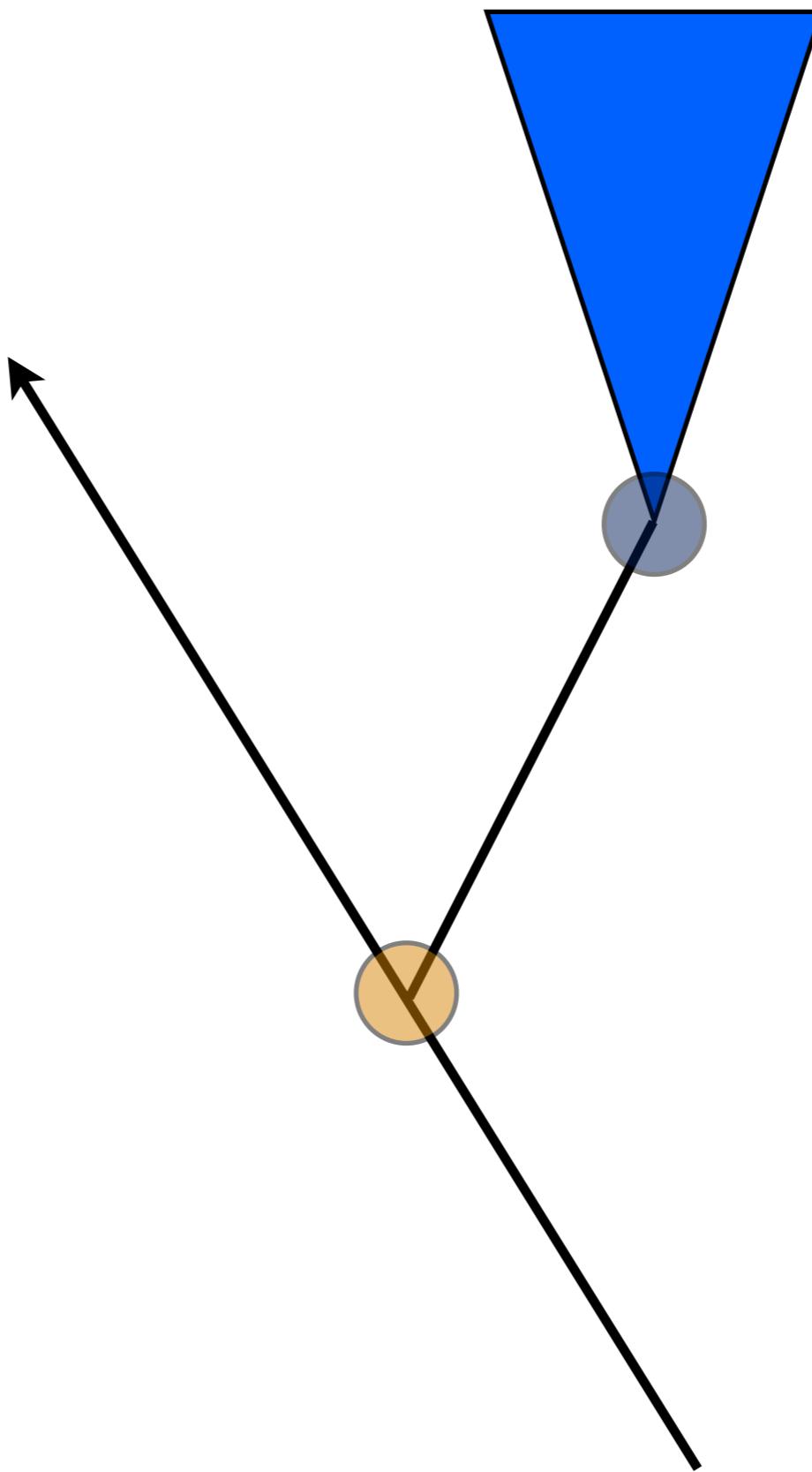
other stuff

lissamphibia
node name

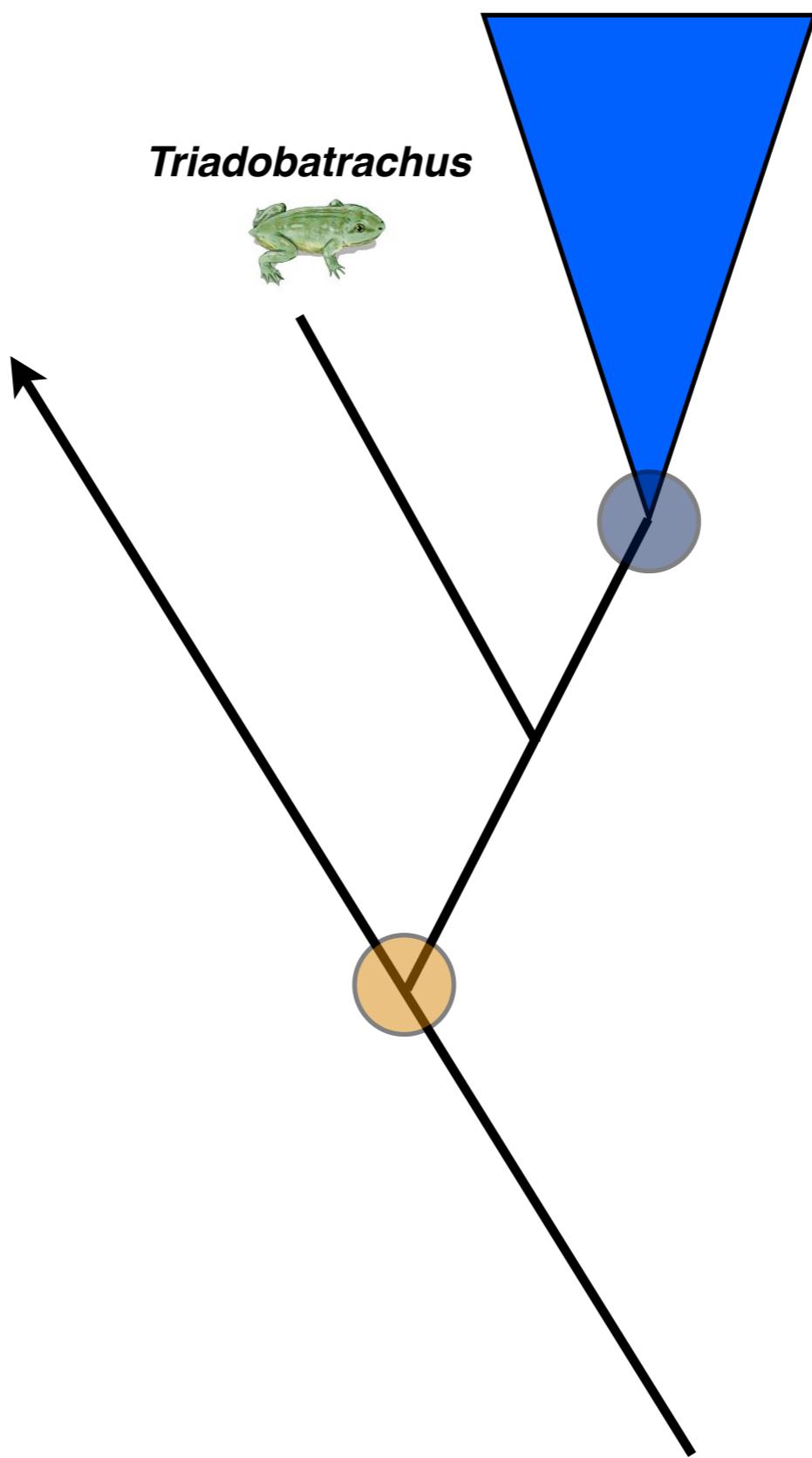
amphibia
stem name



living
amphibians

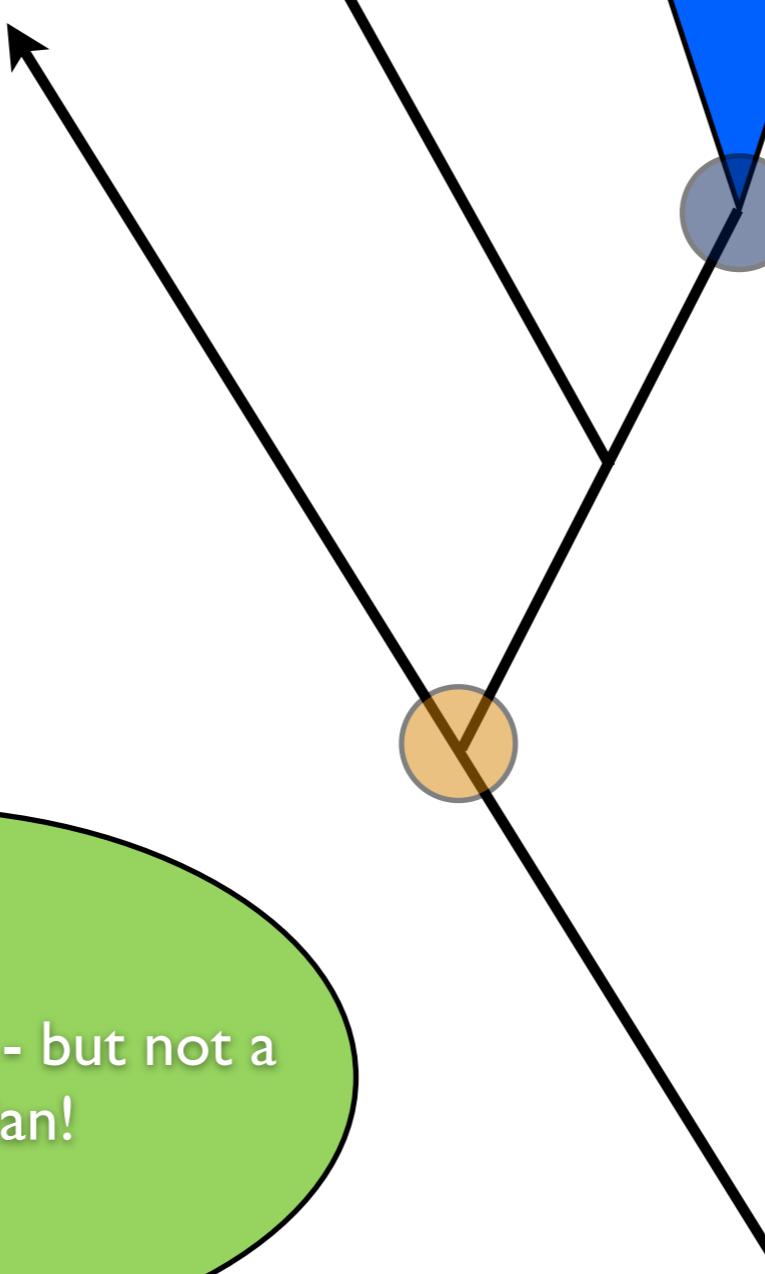
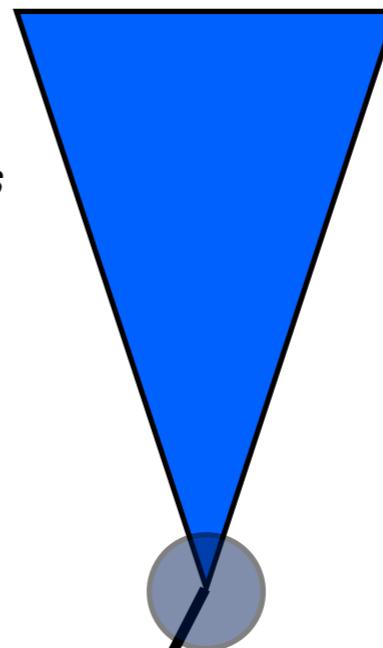


living amphibians

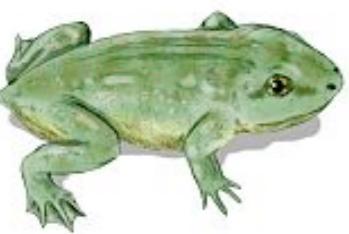


living amphibians

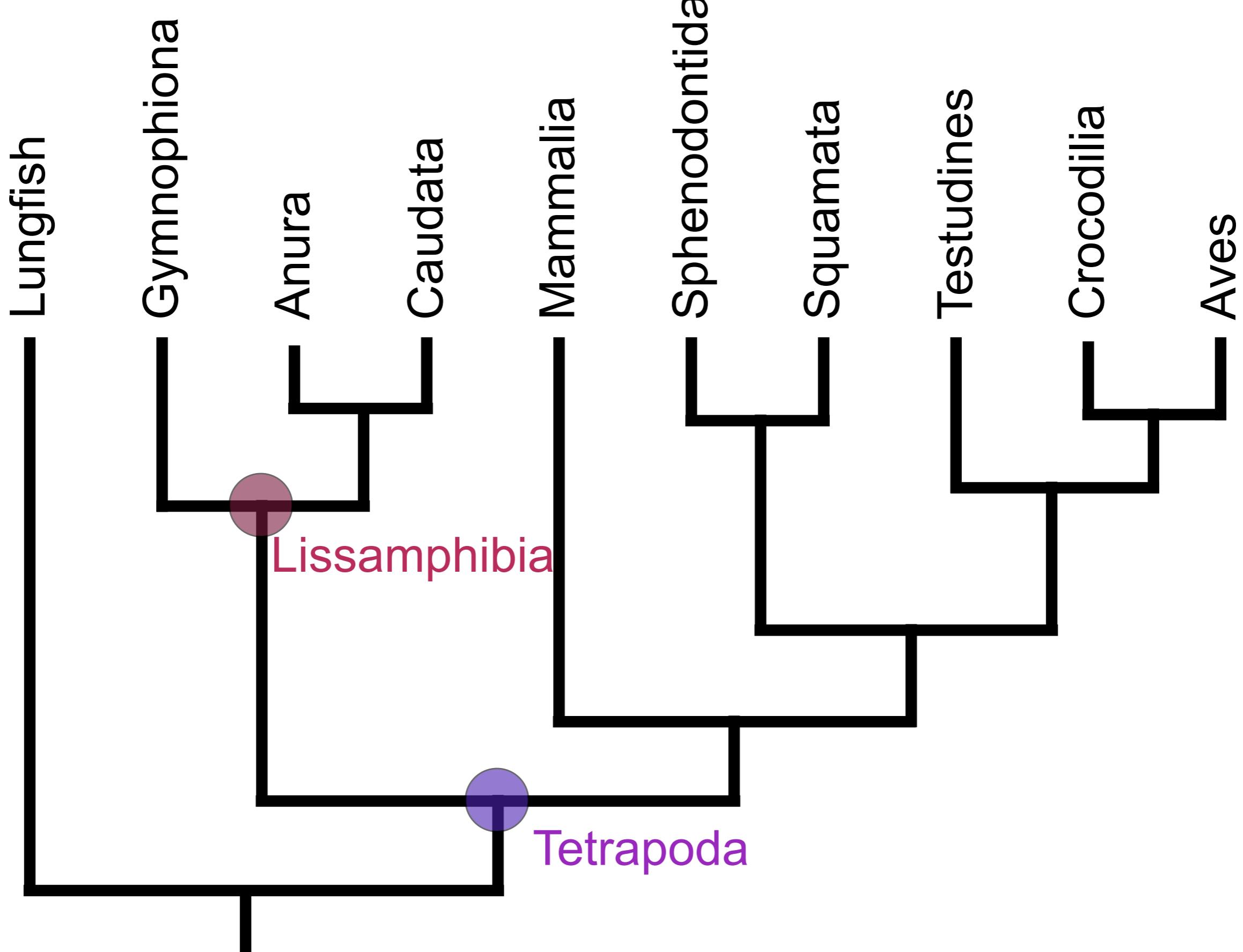
Triadobatrachus



I am an amphibian - but not a
lissamphibian!



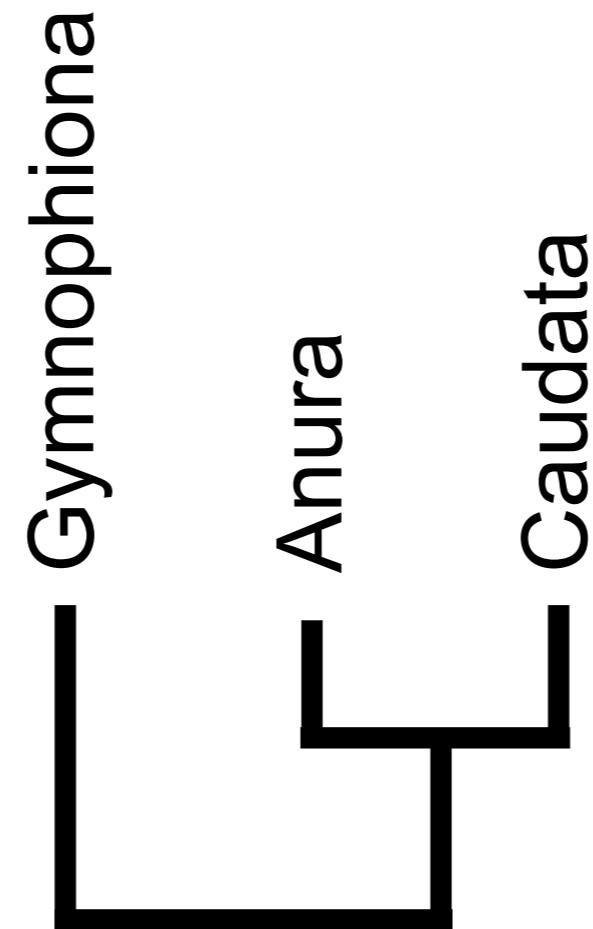
Systematics of living “herps”



Lissamphibia

- Caecilians + frogs + salamanders
- Living lissamphibia are monophyletic

The living amphibians



Gymnophiona

- Caecilians, ~186 species
- Gymnophiona = “naked snake”
- Tropical, except Madagascar and Australia



Anura

- Frogs
- About 5000 species
- Very wide distribution,
huge range of habitats
- Stout body, protruding
eyes, no tail

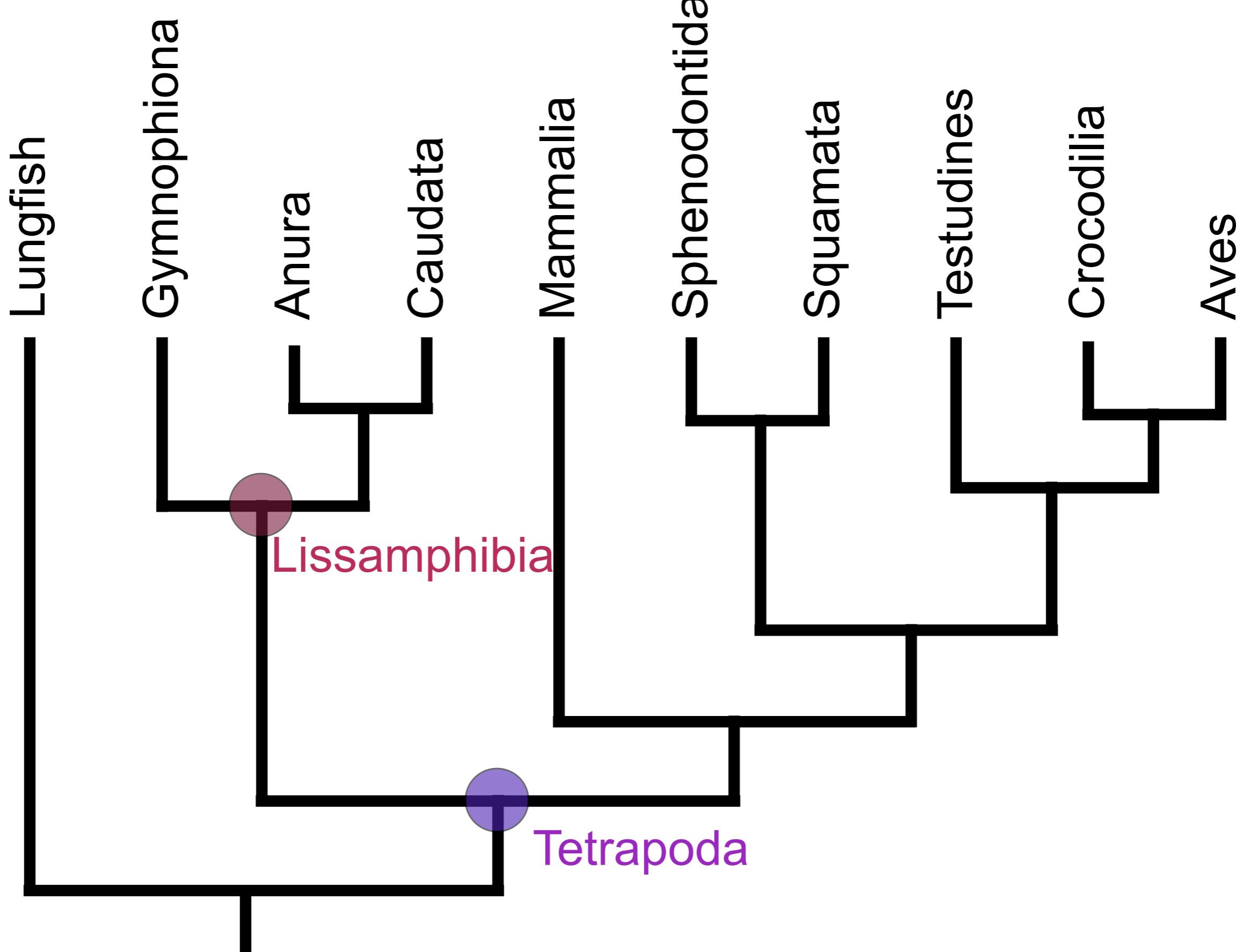


Caudata

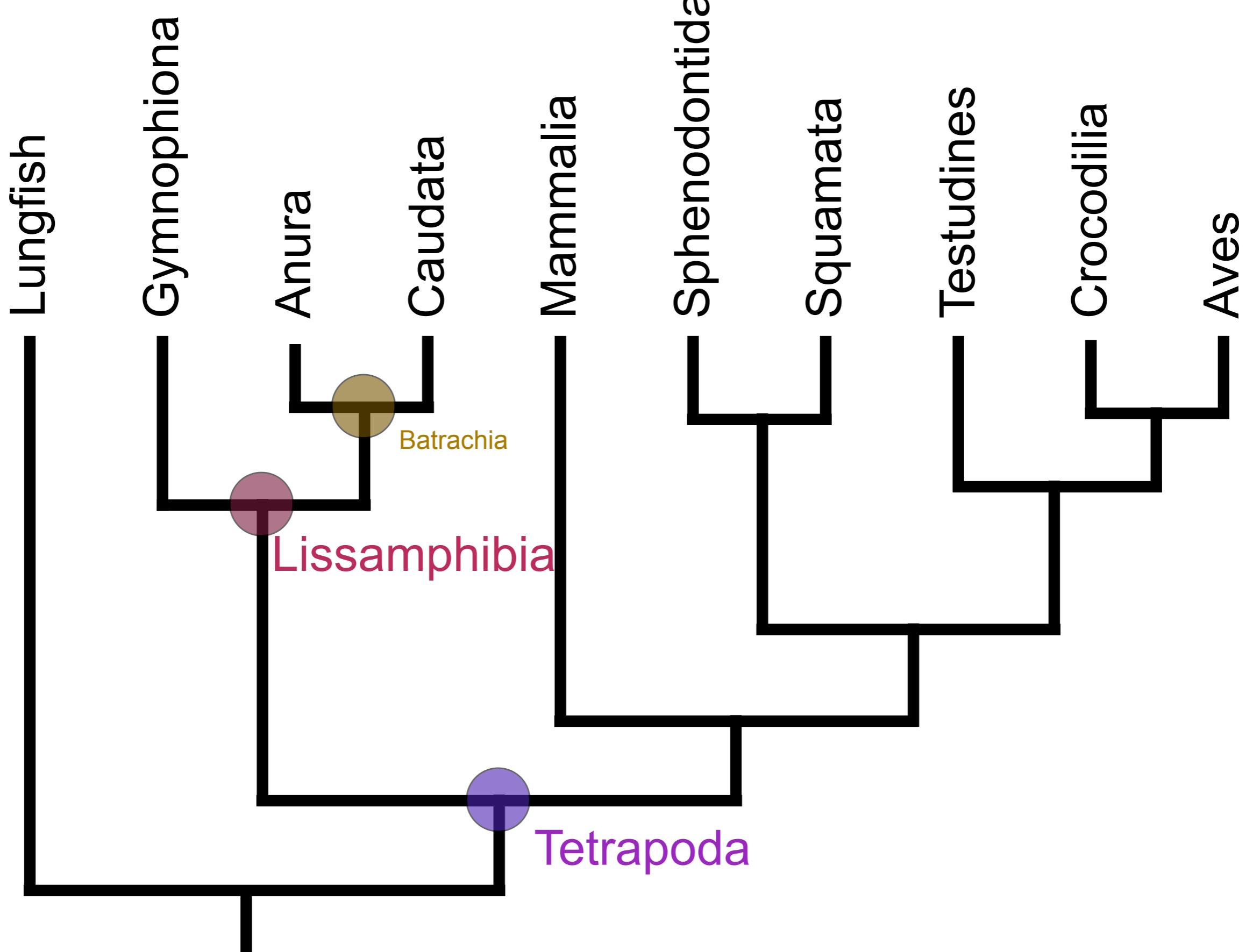
- Salamanders
- About 550 species
- Aquatic or terrestrial, usually found near water



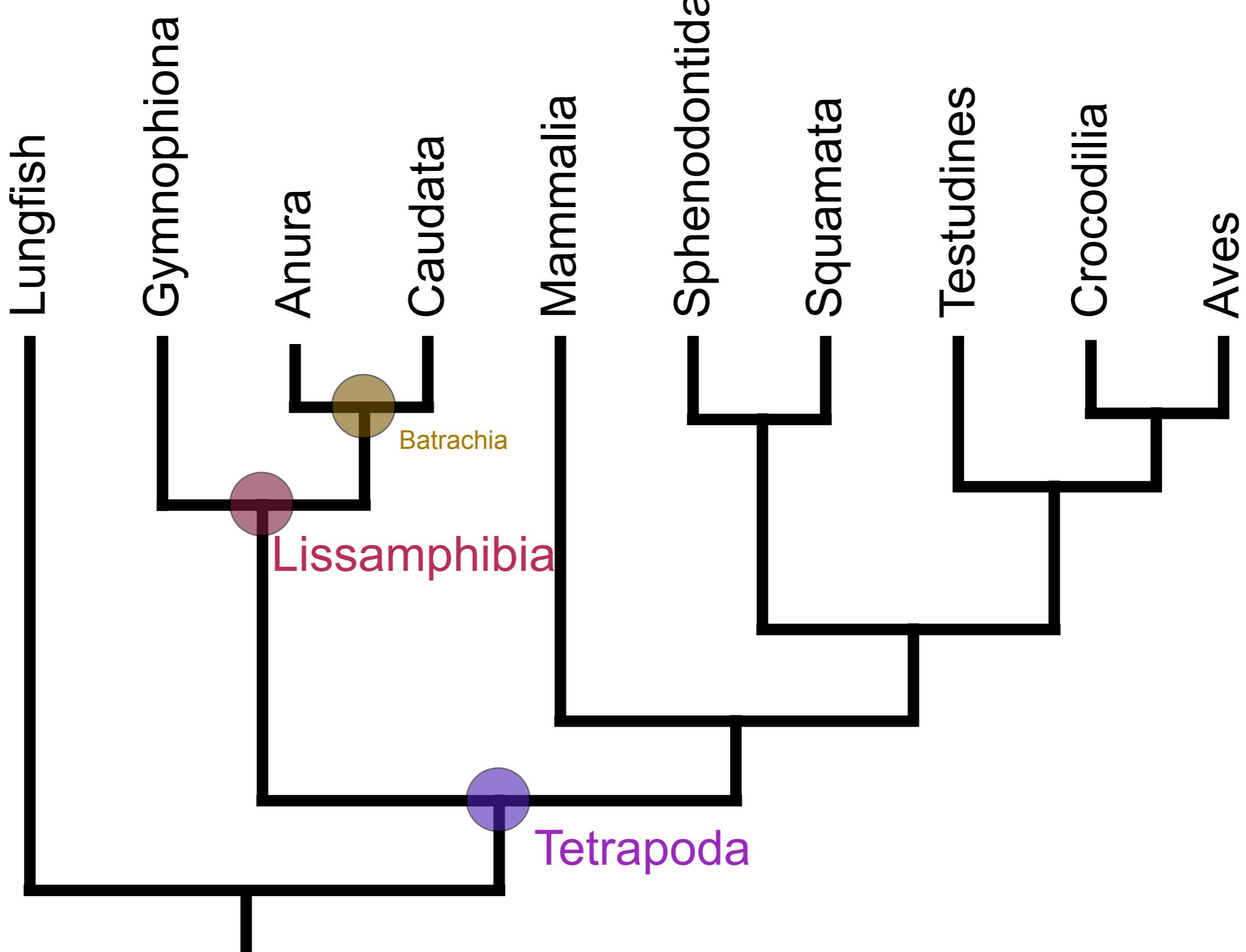
Systematics of living “herps”



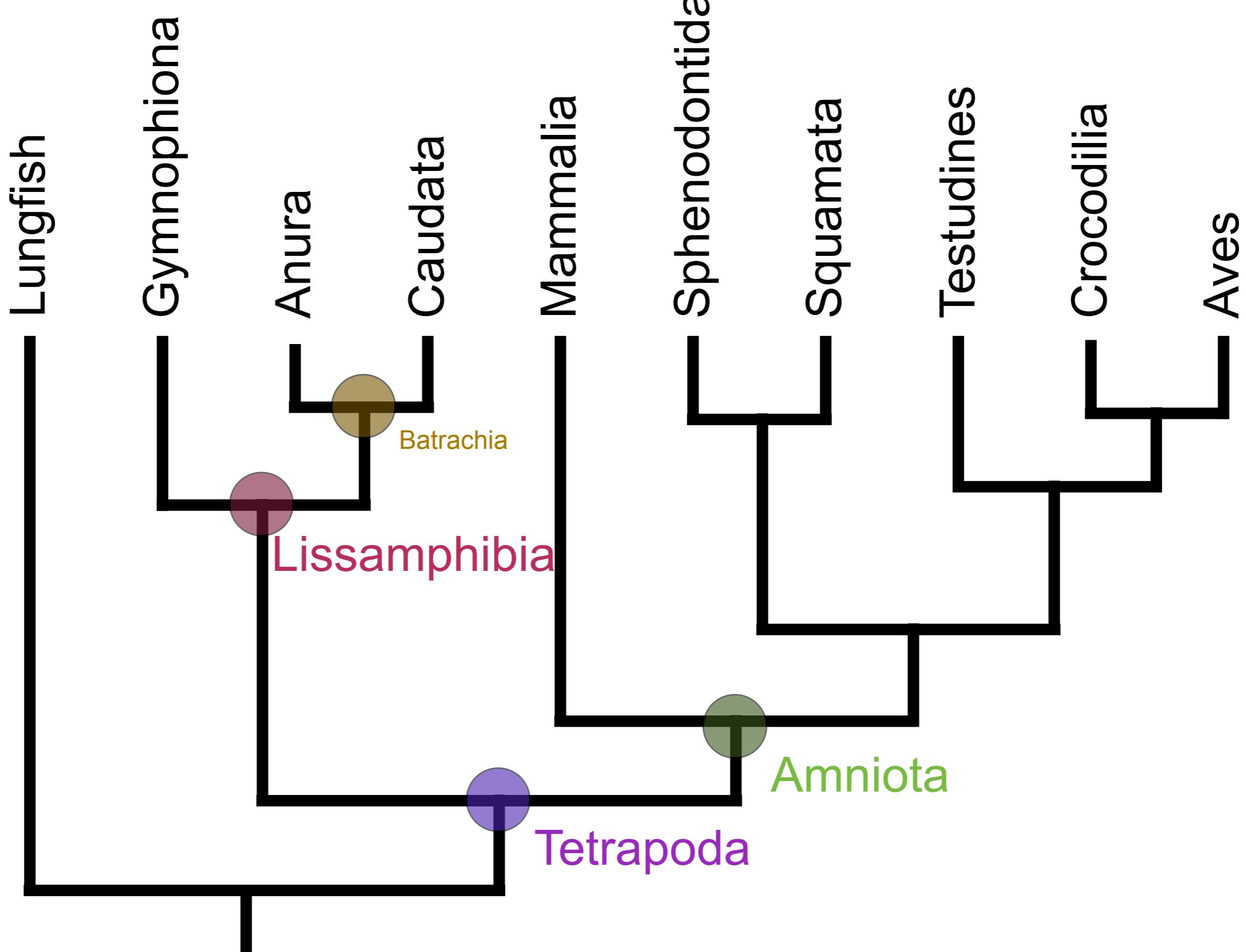
Systematics of living “herps”



Systematics of living “herps”

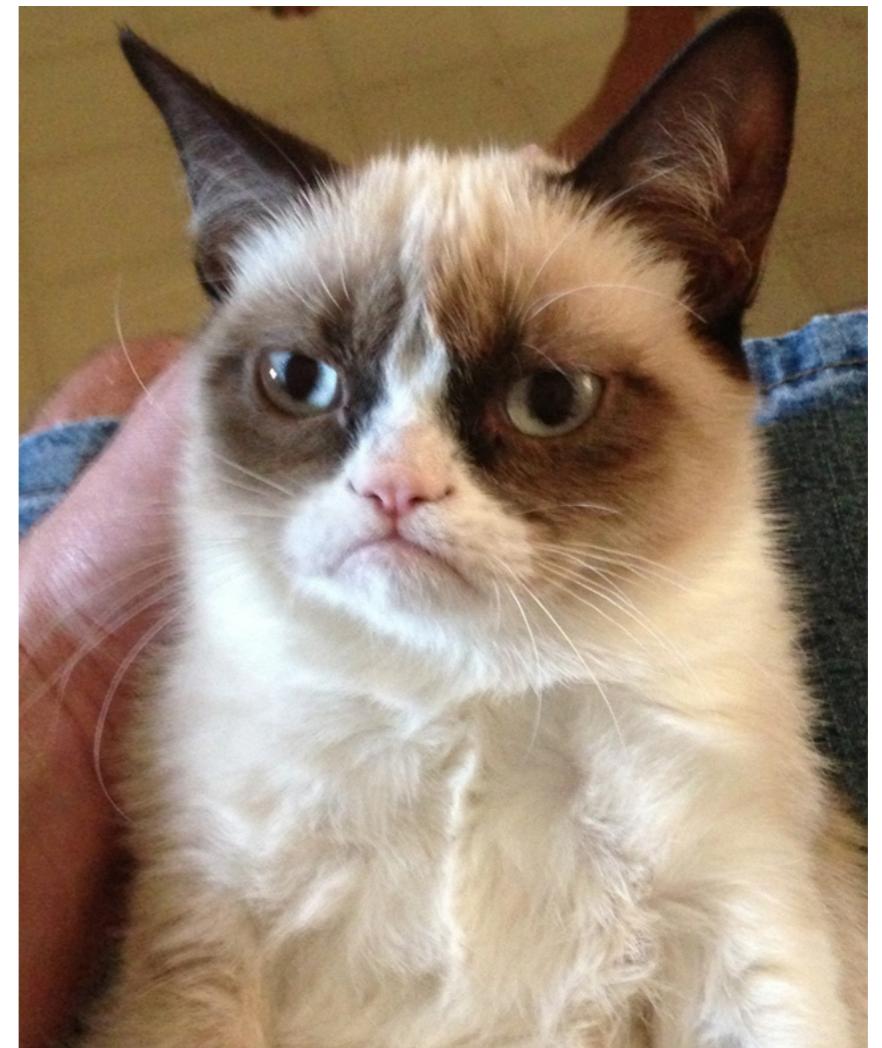


Systematics of living “herps”

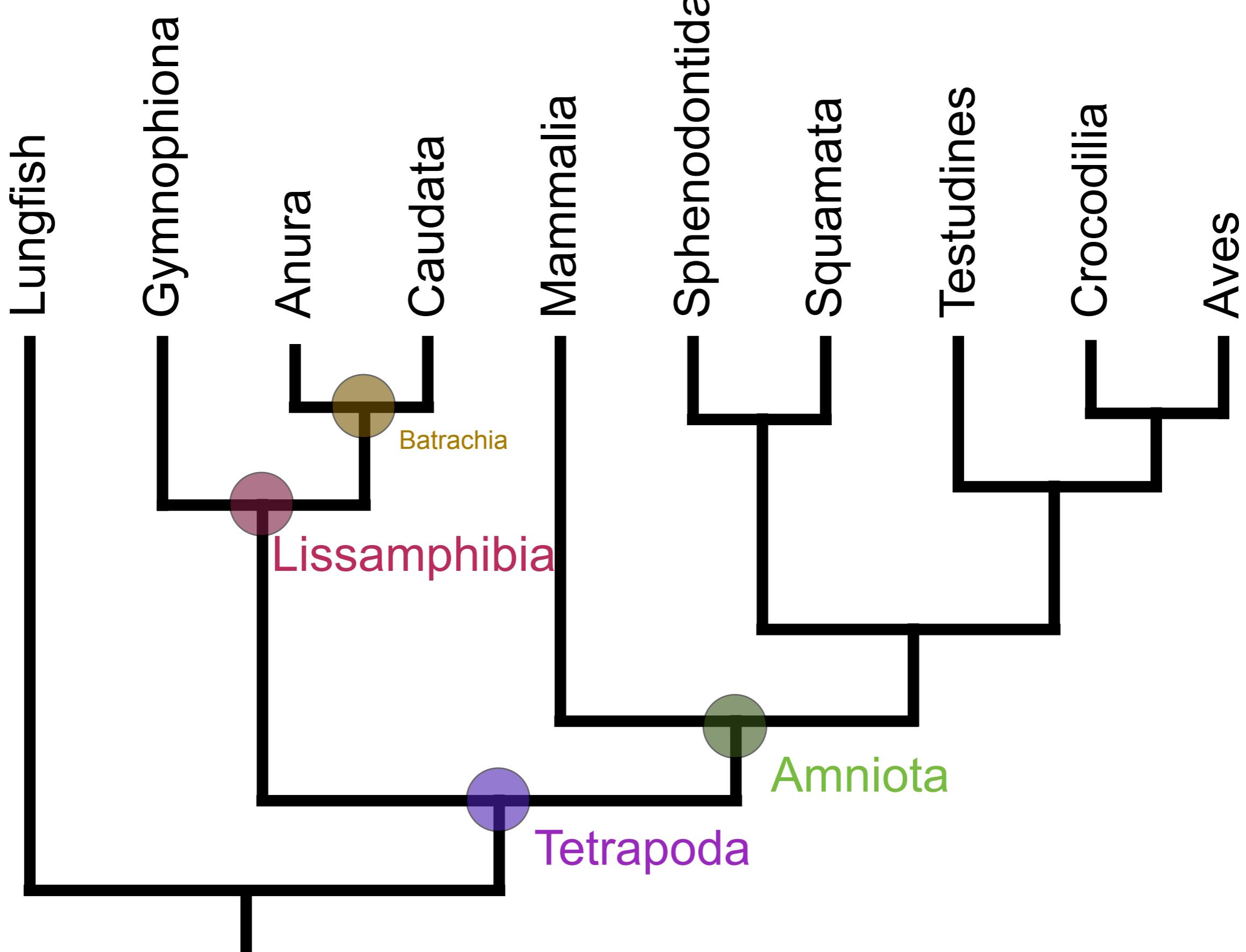


Amniota

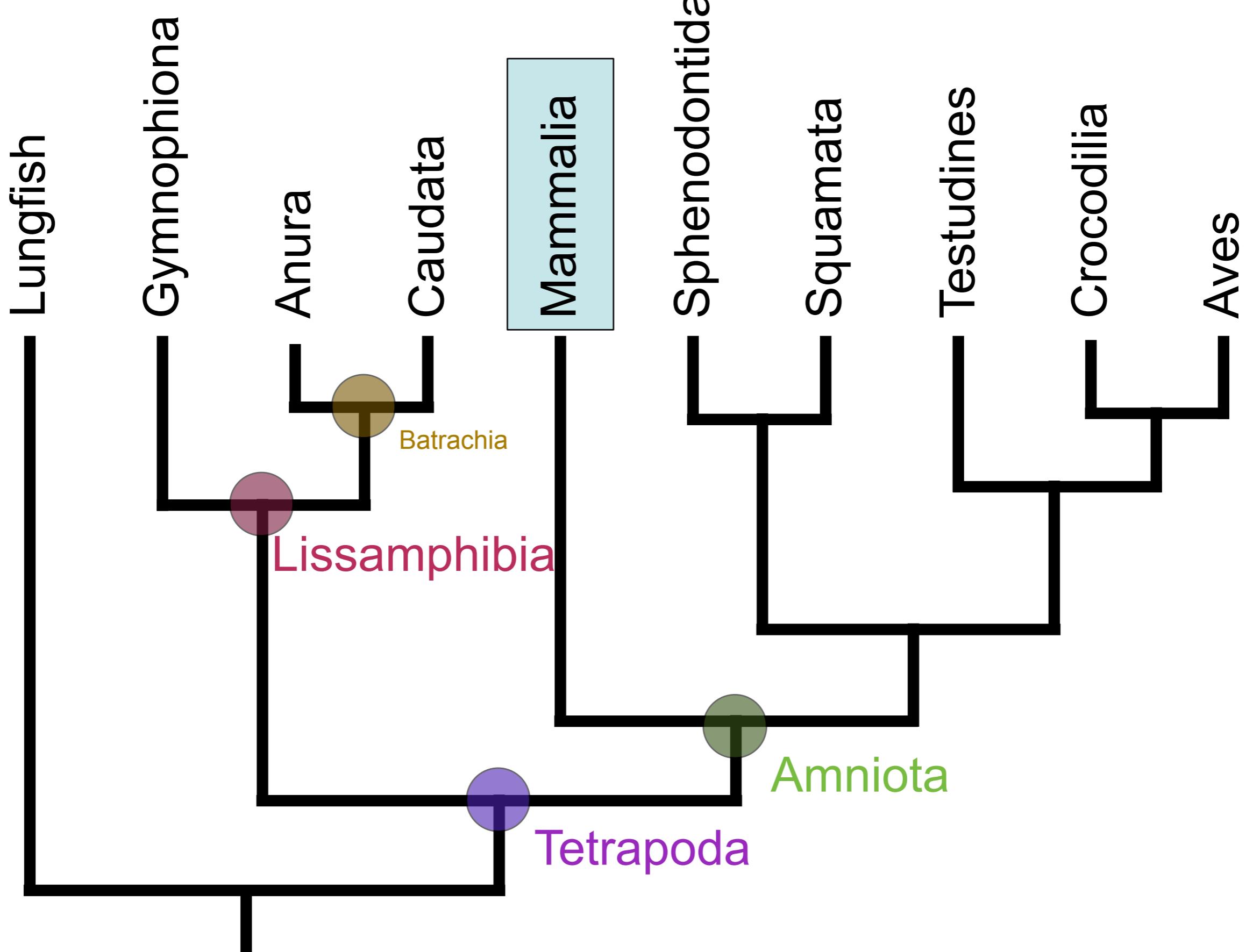
- Synapsids + sauropsids (e.g. reptiles including birds)
- Characterized by an amniotic egg
- Adaptation to life on land, free of the need to return to water



Systematics of living “herps”



Systematics of living “herps”



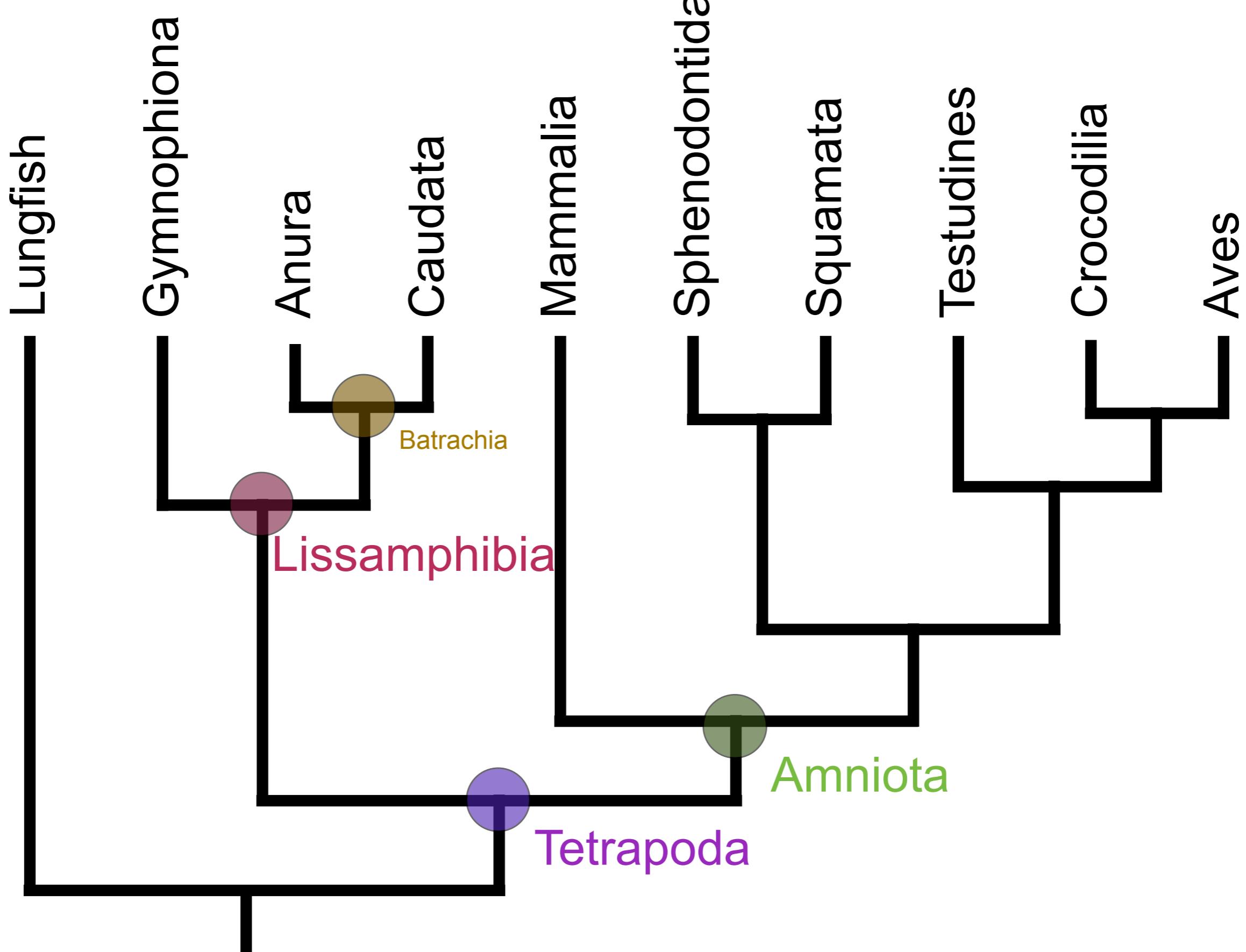
Mammalia

- About 5400 species in 1200 genera
- Endotherms with fur, sweat glands, mammary glands, four chambered heart, etc.

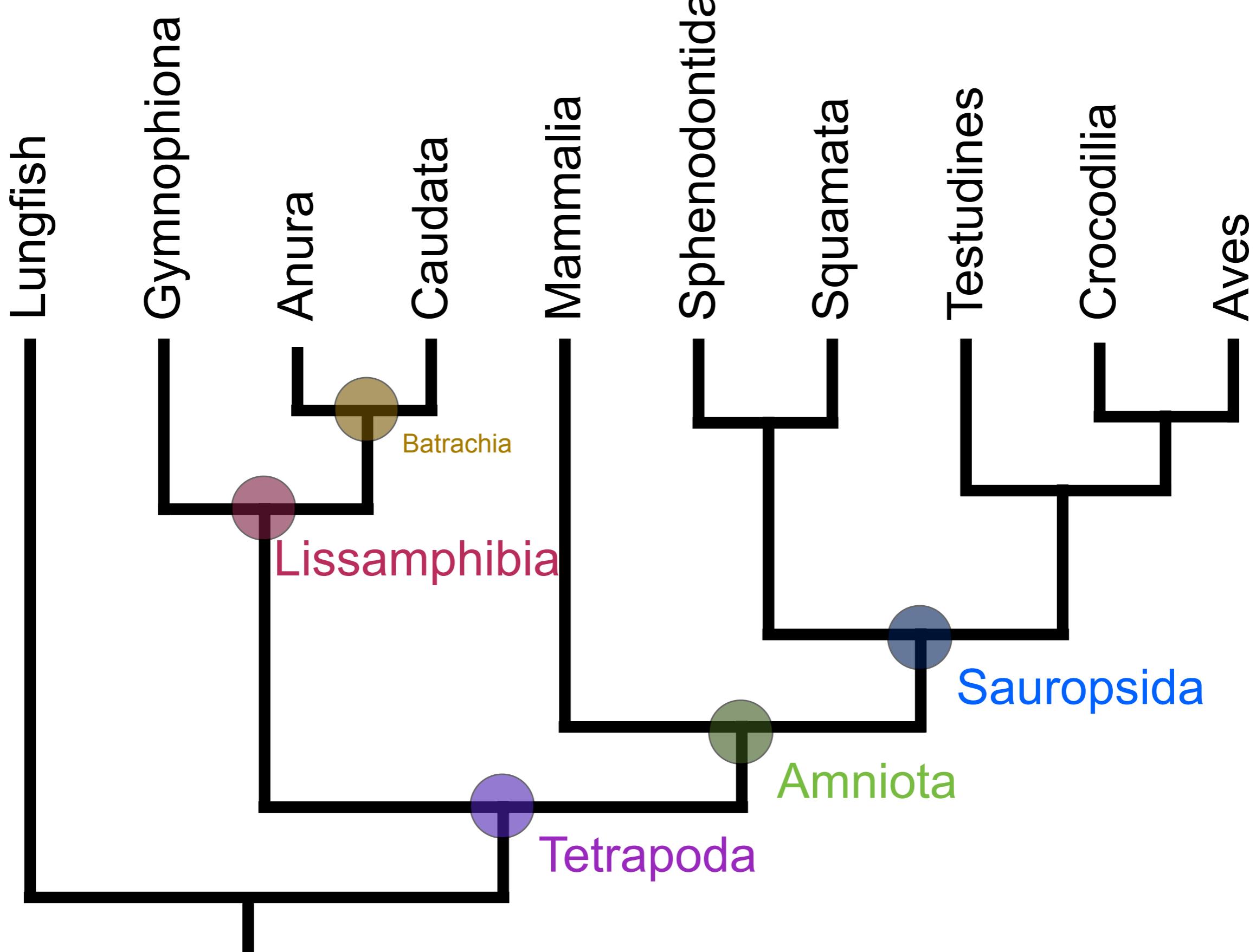


Typical mammal

Systematics of living “herps”



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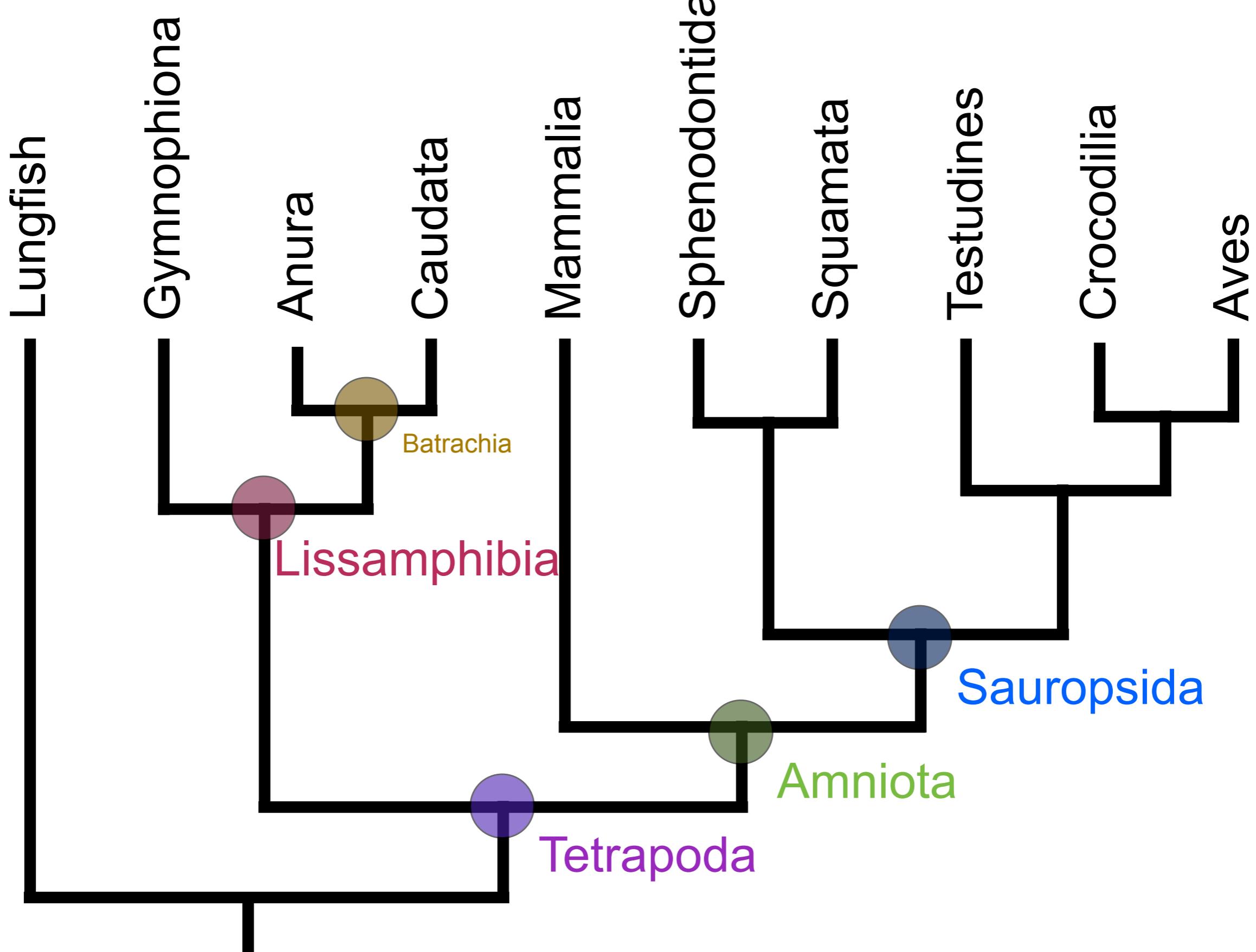


Sauropsida

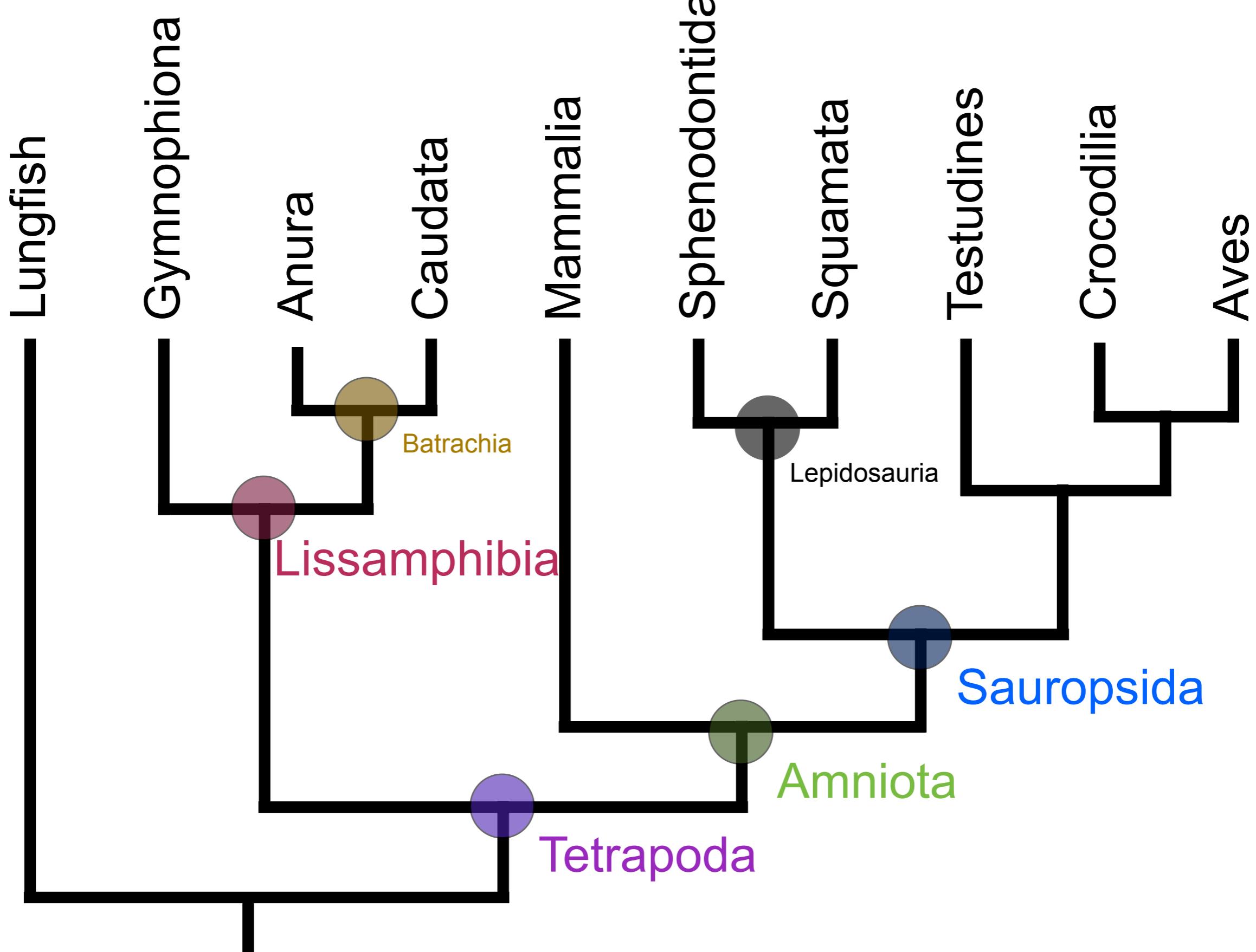
- Reptiles
- Extremely diverse group that lives in a wide variety of habitats around the world
- Includes birds and other dinosaurs



Systematics of living “herps”



Systematics of living “herps”

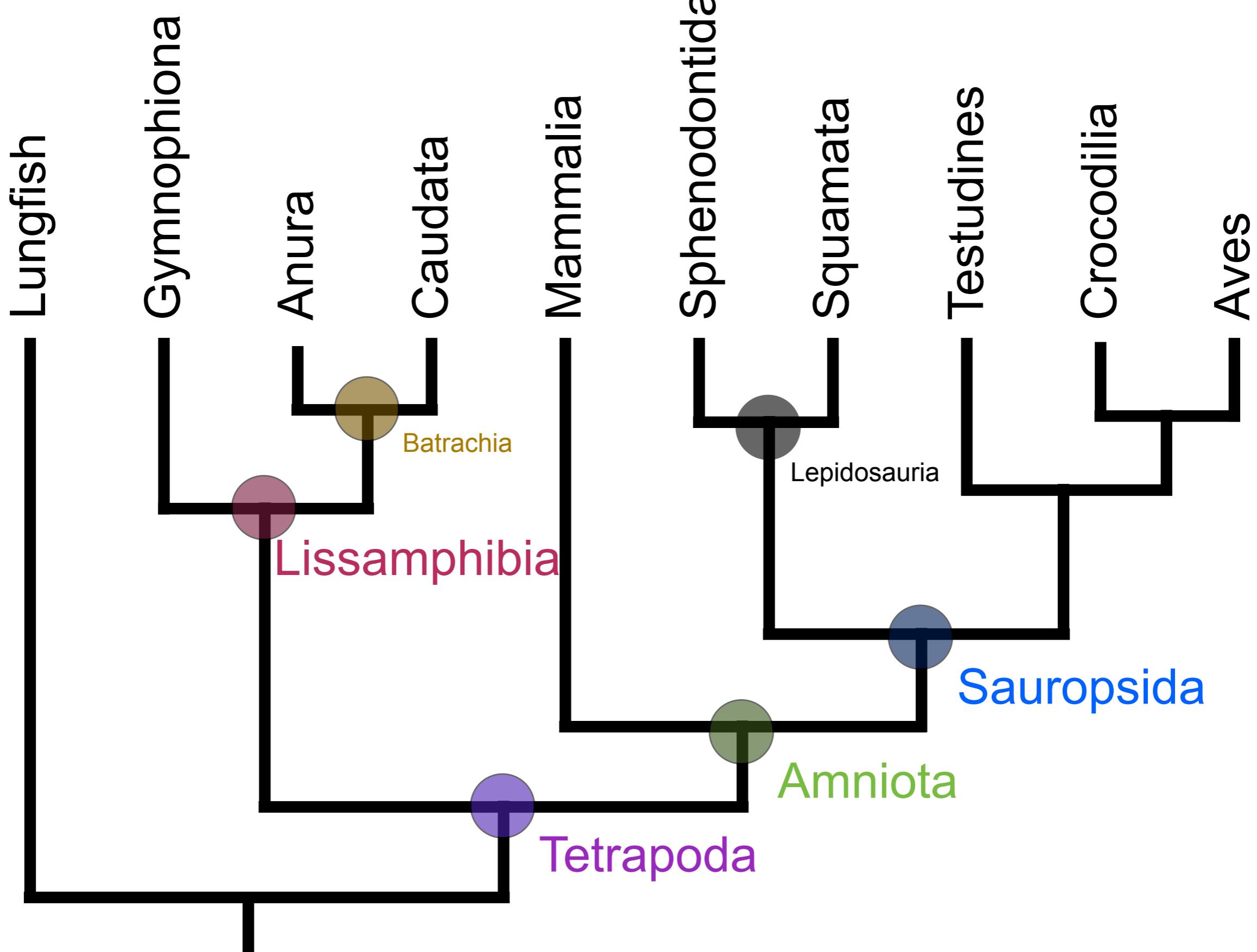


Lepidosauria

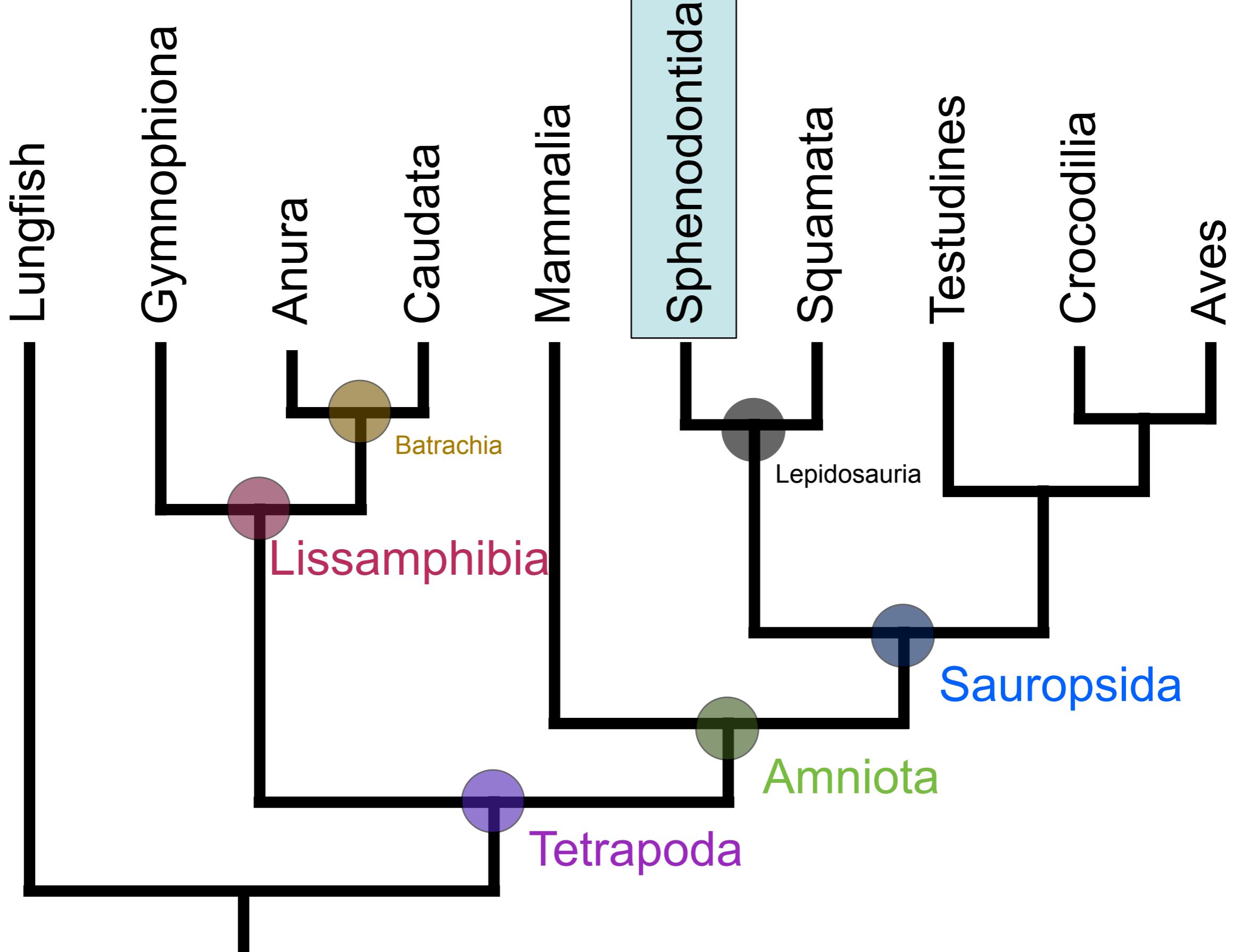
- Reptiles with overlapping scales
- Includes squamates and rhynchicephalians



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Systematics of living “herps”



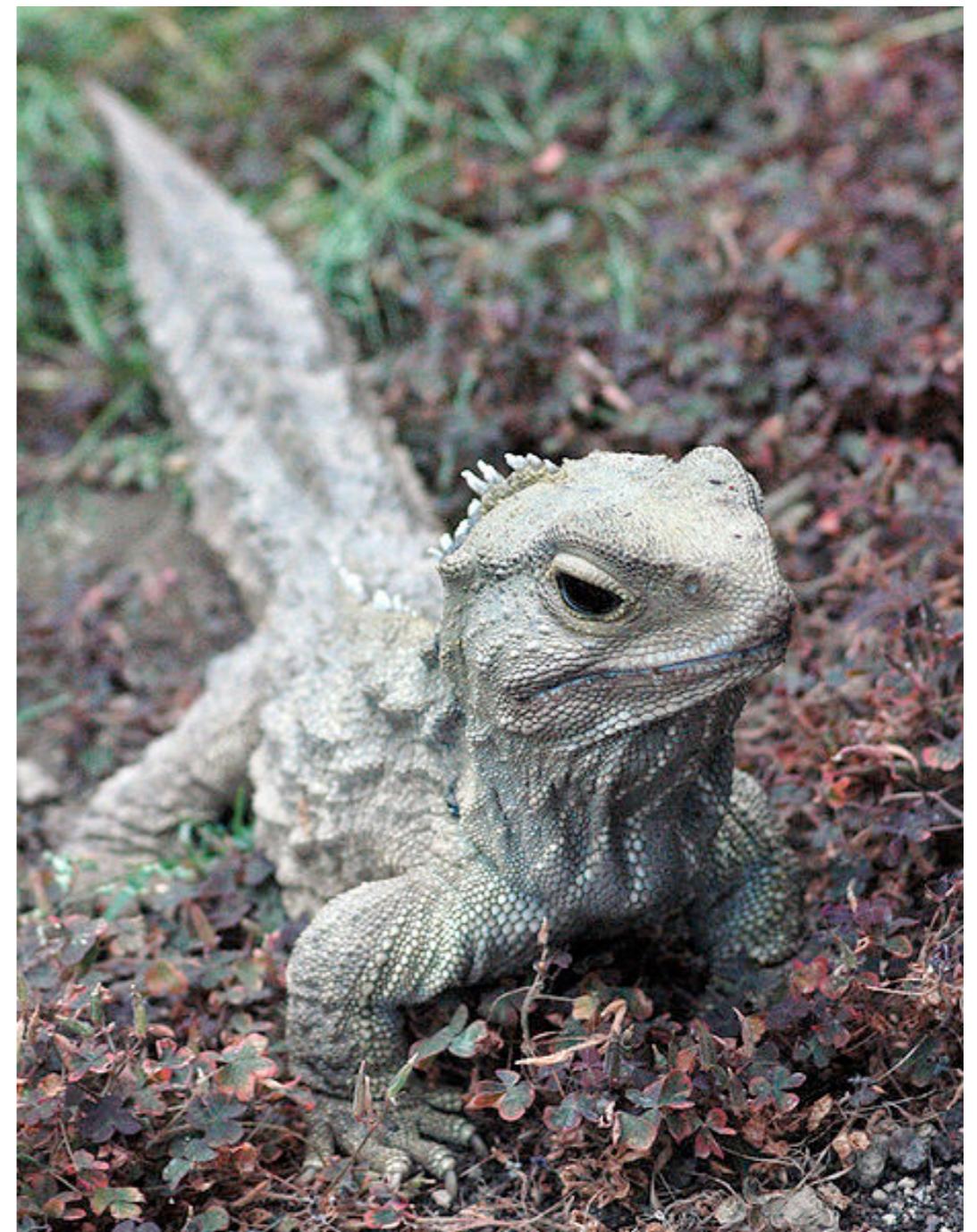
Sphenodontida

- Tuataras
- 2 species in one genus, New Zealand
- Very distinctive morphology, but lizardlike
- Terrestrial, live in burrows, tolerate cold temps
- Primarily insectivorous
- Long-lived
- Small coastal islands; Half live on Stephens Island

Sphenodontida

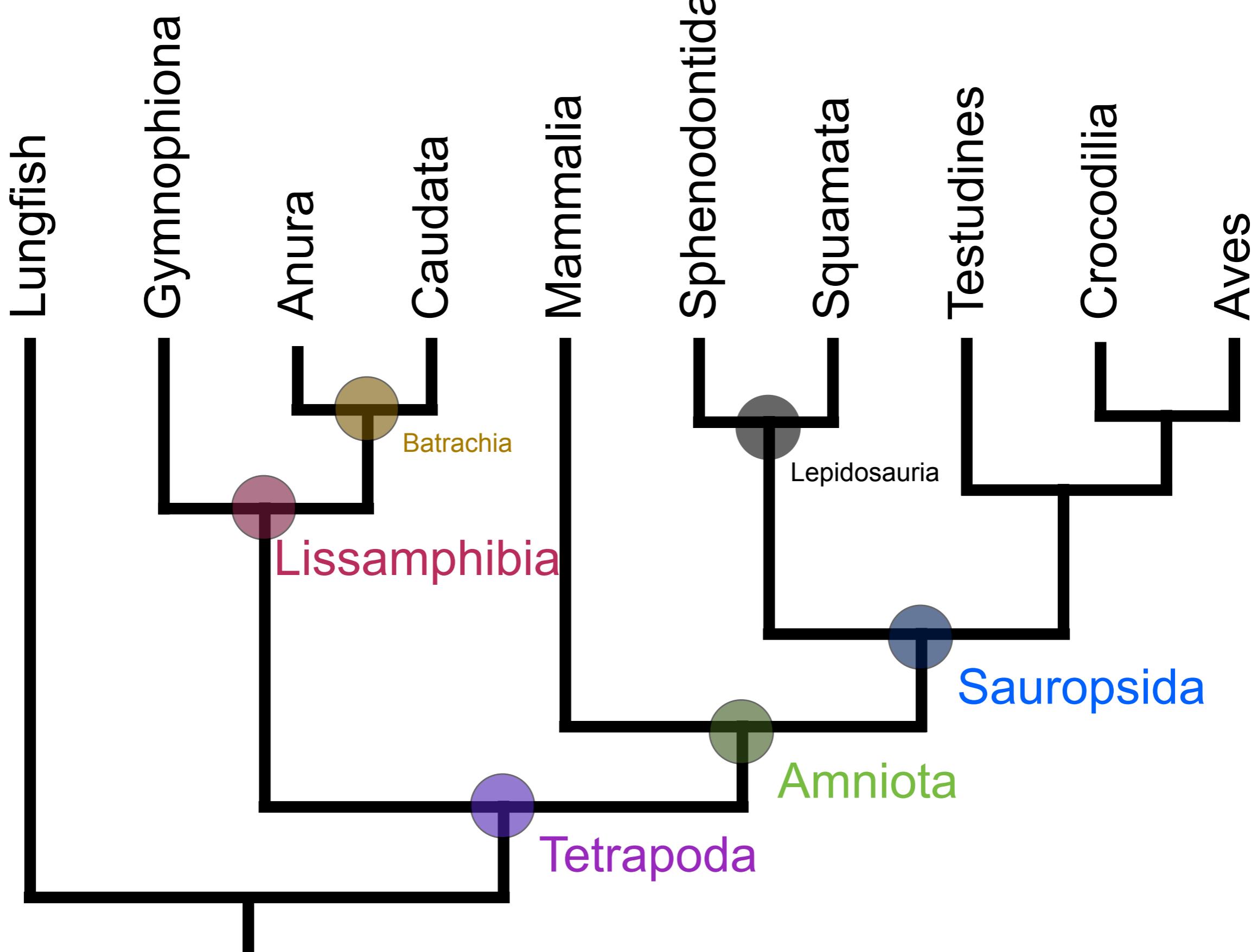


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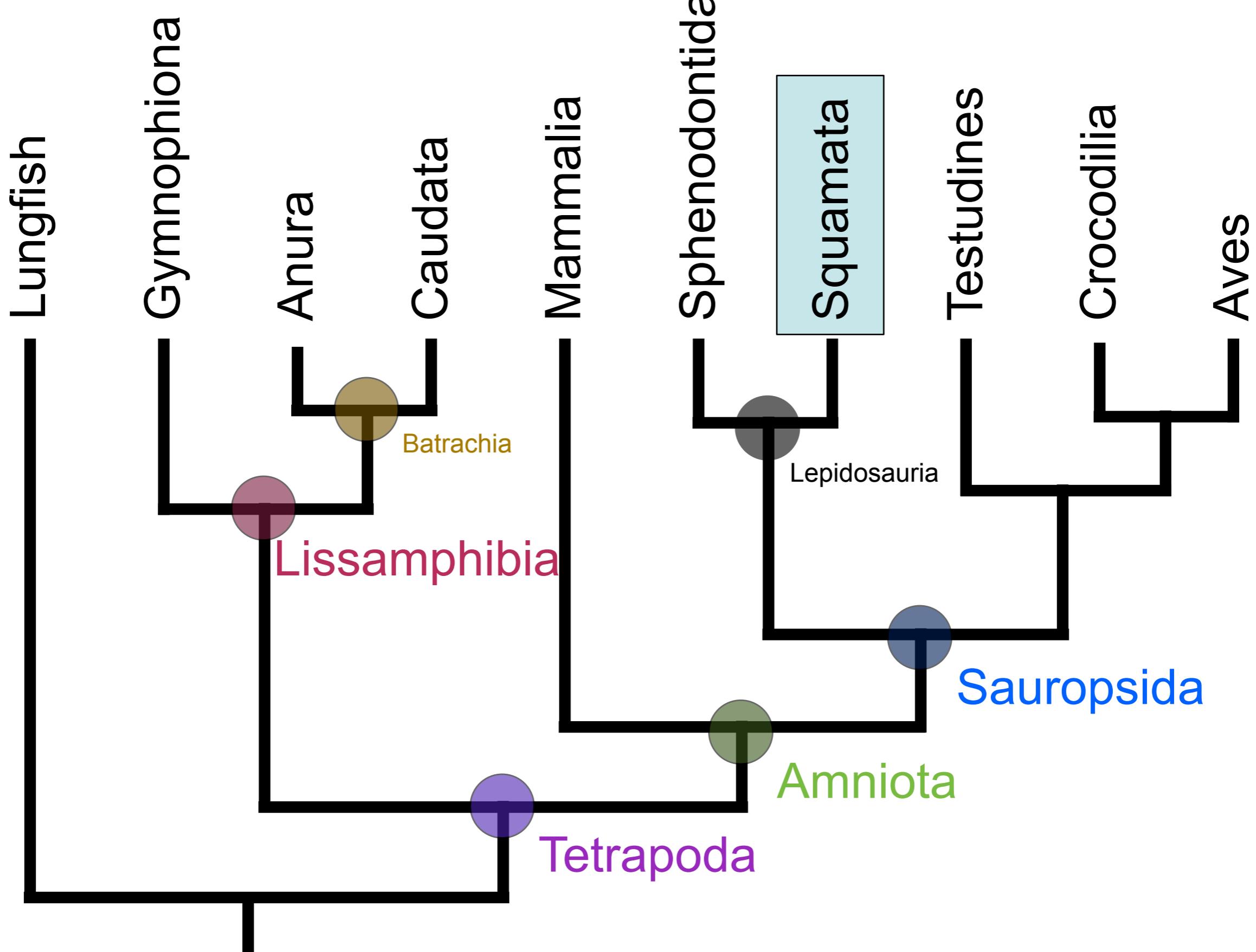


Sphenodon punctatus

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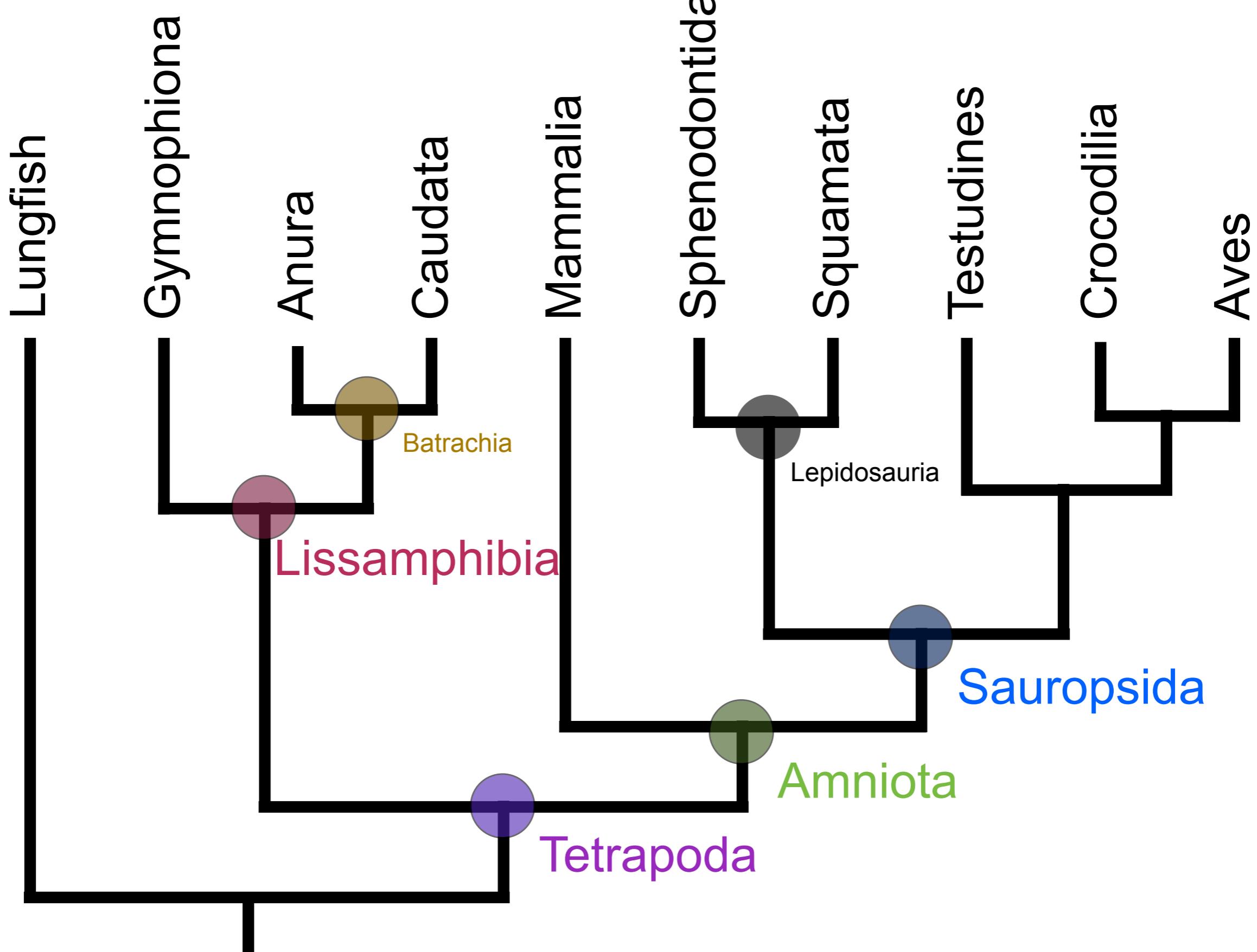
Systematics of living “herps”



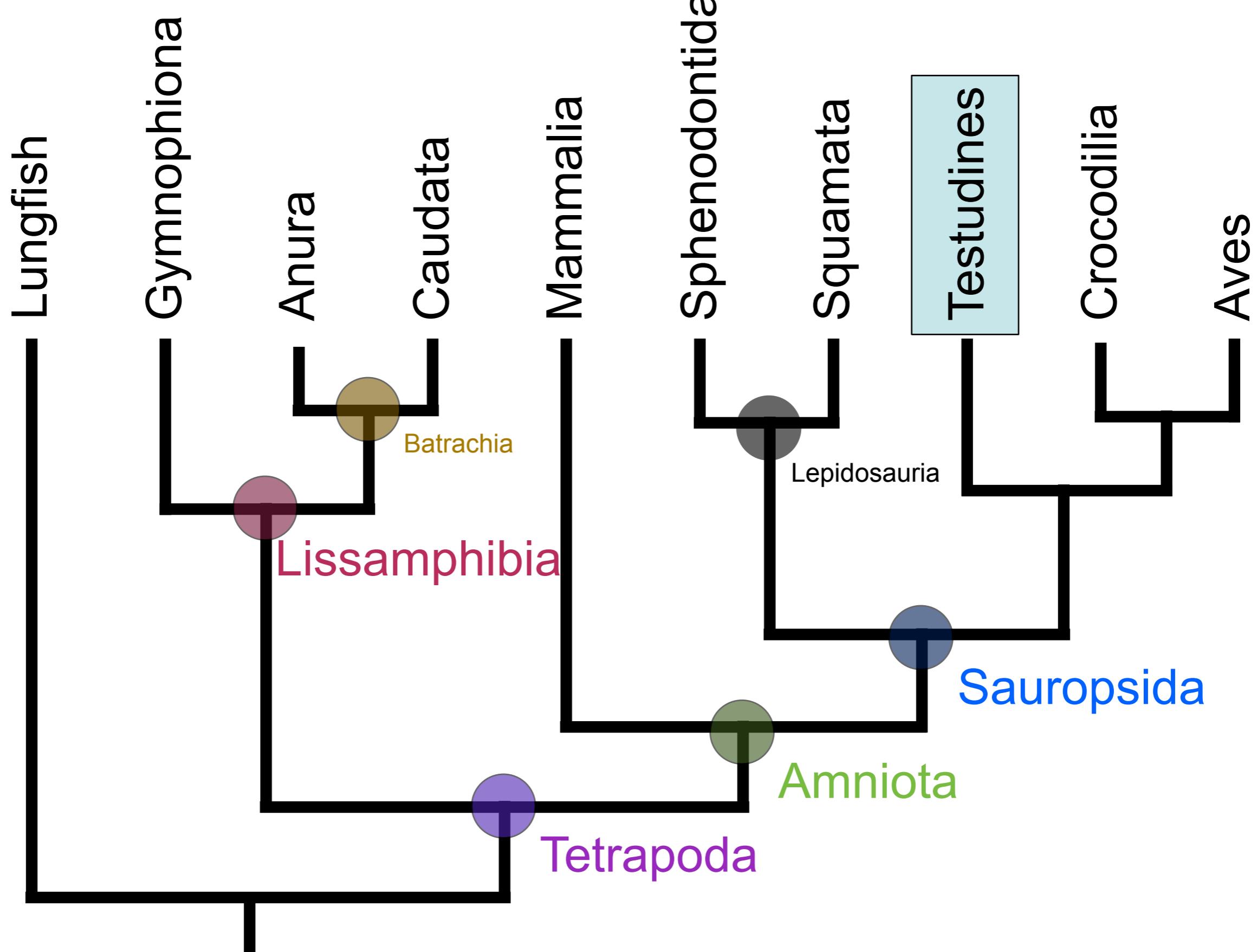
Squamata

- Snakes and lizards
- More than 7000 species
- Large number of shared derived characters

Systematics of living “herps”



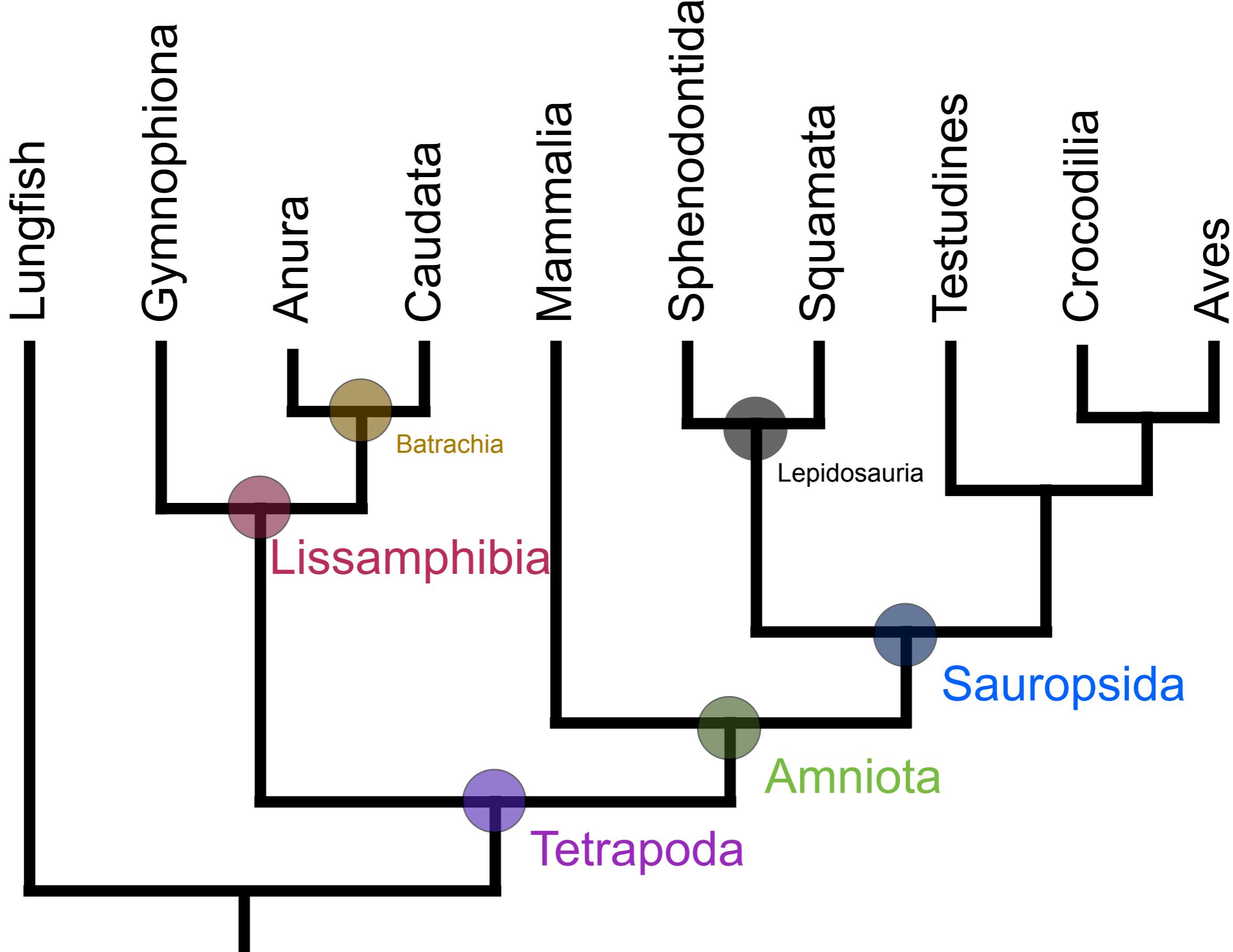
Systematics of living “herps”



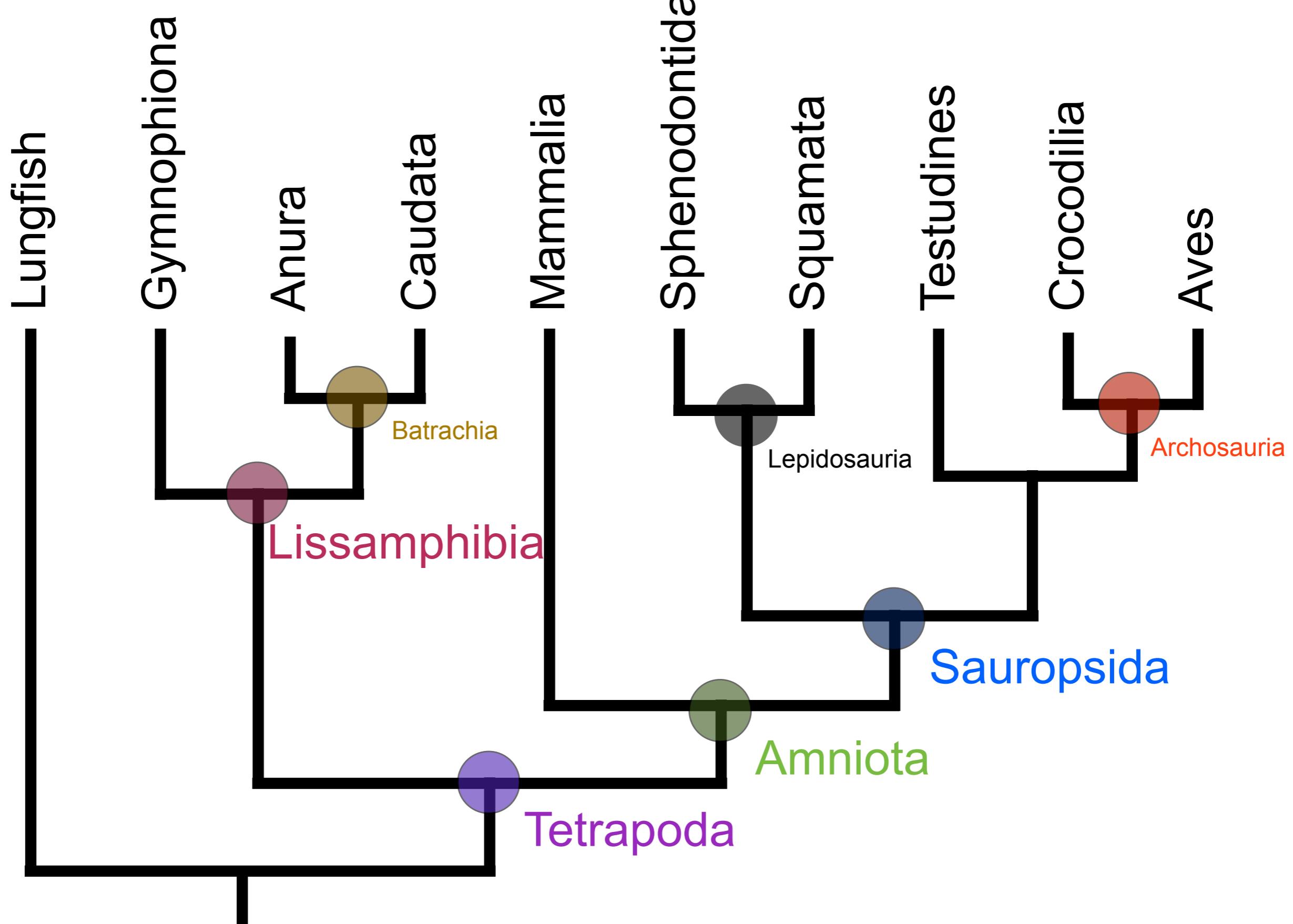
Testudinides

- Fossils from at least 210 mya
- Anapsid skull
- Toothless jaws
- Ribs united with bony carapace (top of shell)
- Plastron - bottom of shell

Systematics of living “herps”



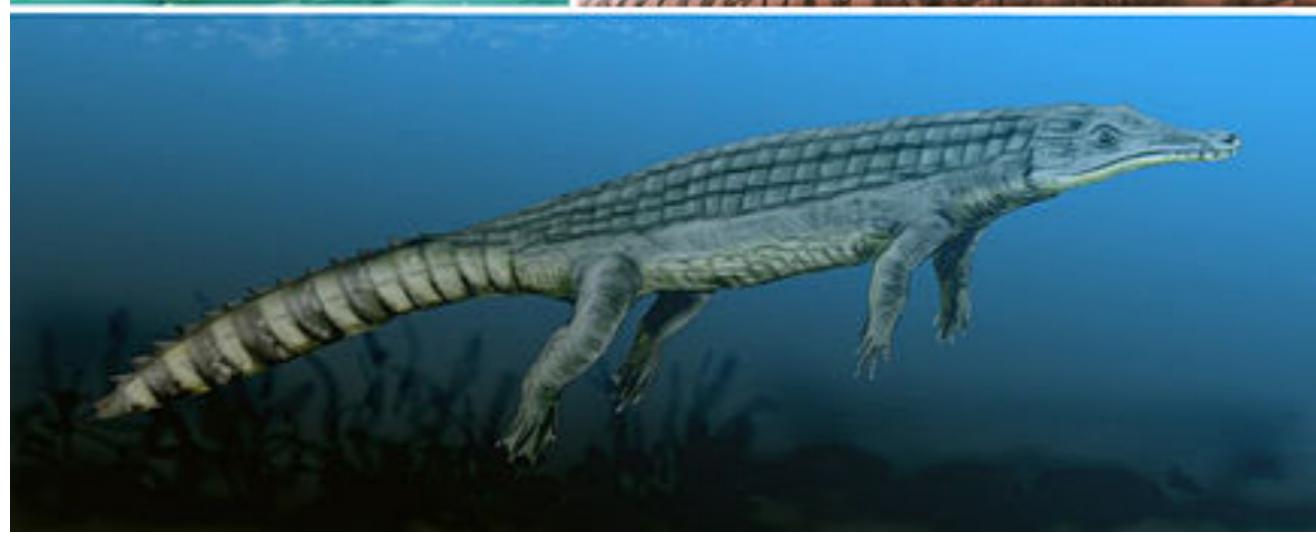
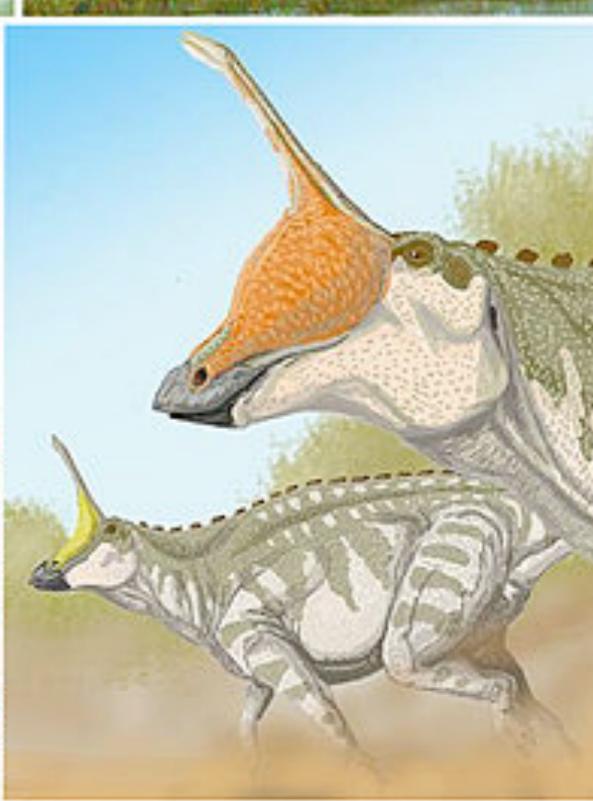
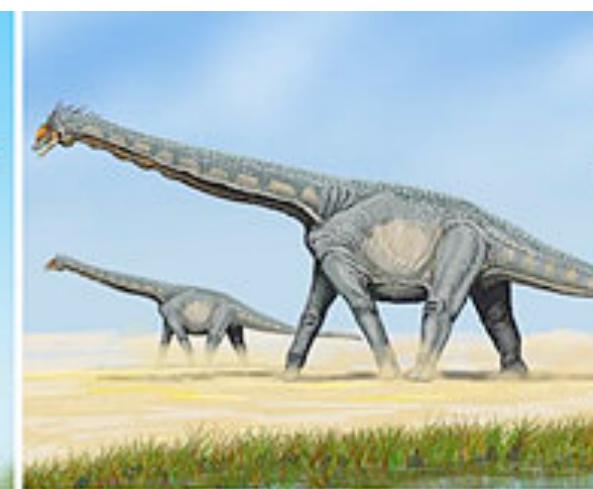
Systematics of living “herps”



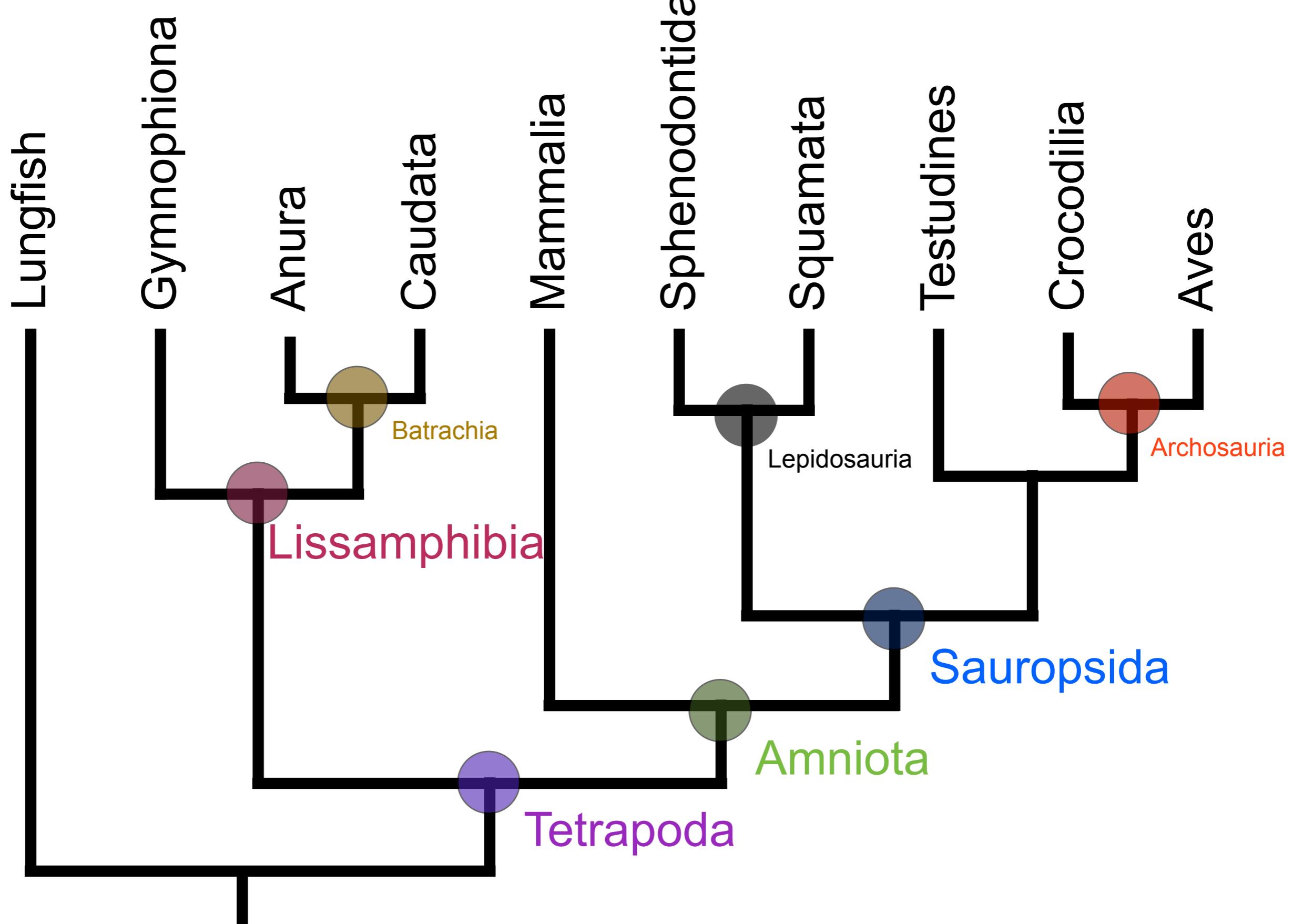
Archosauria

- Crocodiles, dinosaurs (including birds), and pterosaurs
- 100% awesome

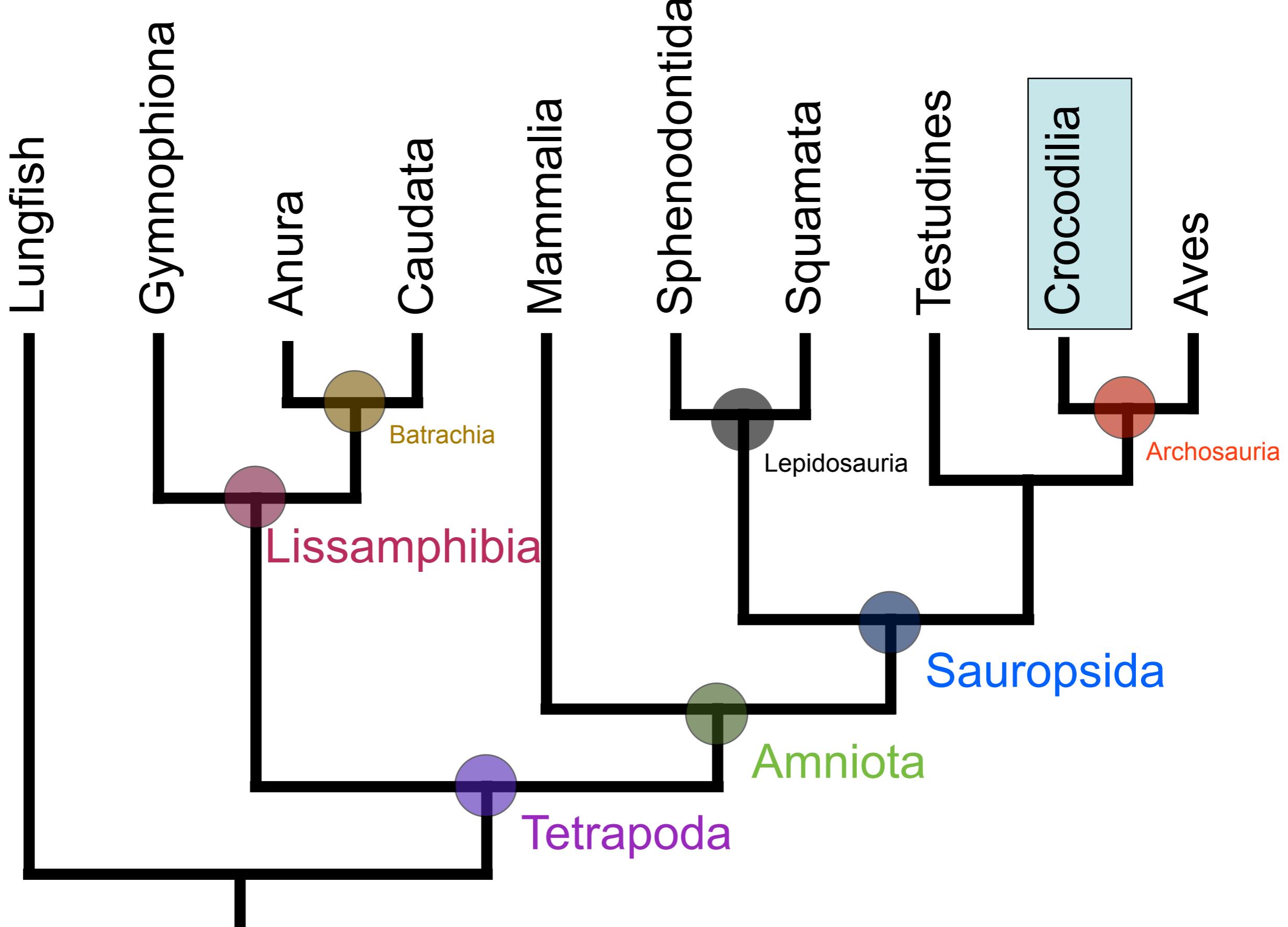




Systematics of living “herps”



Systematics of living “herps”



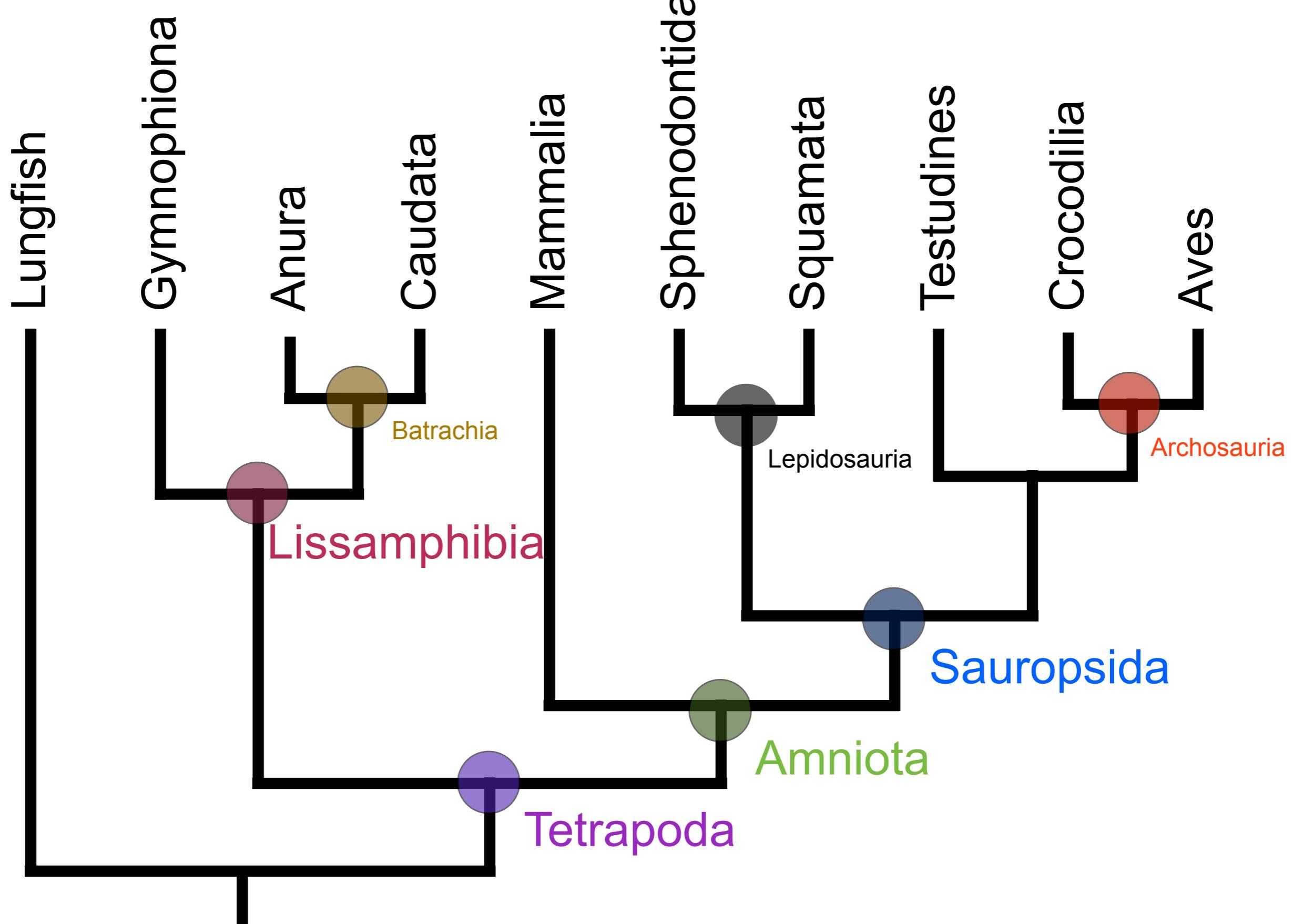
Crocodilia

- Alligators, caimans, crocodiles, gharials
- 25 species
- Big size range
- Large rivers, swamps, lagoons, ocean

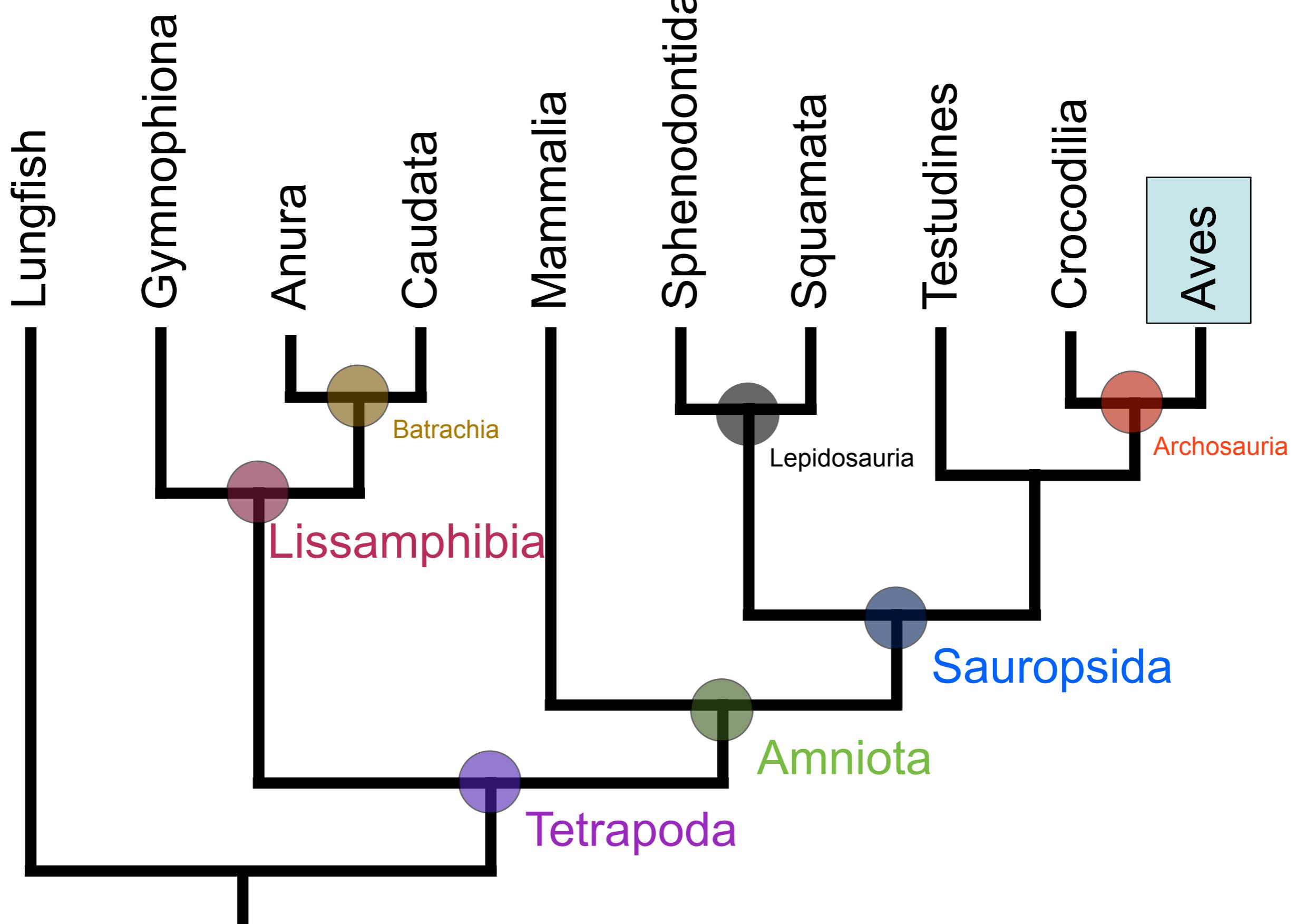
Saltwater Crocodile (*Crocodylus porosus*)



Systematics of living “herps”



Systematics of living “herps”



Aves

- ~10000 species
- Feathers, flight, beaks, homeothermy



Systematics of living “herps”

